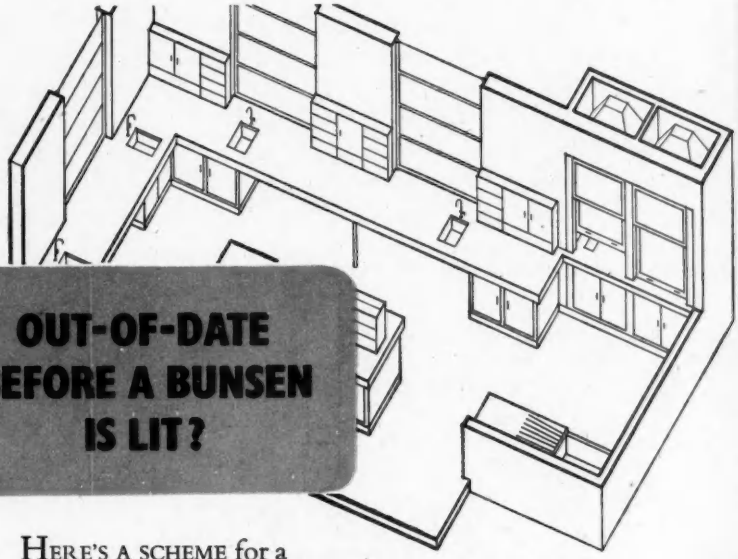
The Chemical Age

VOL LXVII 13 DECEMBER 1952 No 1744



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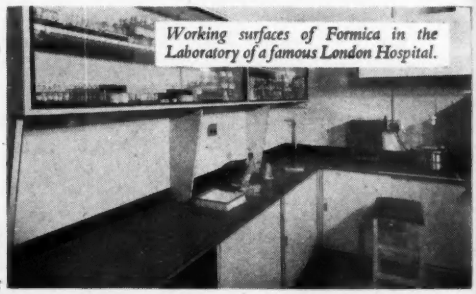

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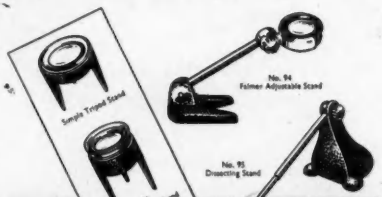

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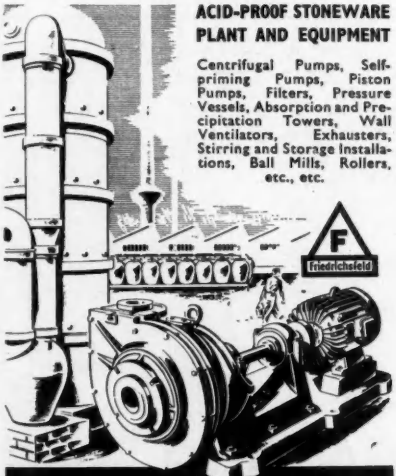

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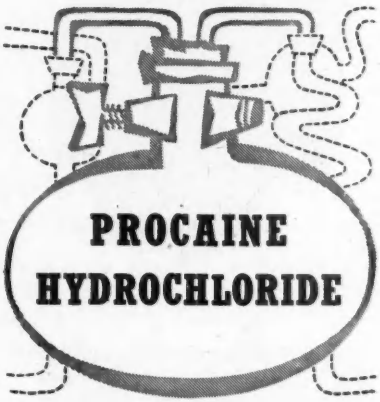

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Is There a Manpower Shortage?

IN recent times there have been a number of articles written and speeches made about the shortage of scientific manpower. Fear of a present or future dearth of scientists has led many responsible people to suggest various remedies; either that we train more scientists or that we dilute them with partially qualified technicians capable of doing routine work, or that we set up more advisory or consultant services and so enable one scientist to do the work of several. Few of the articles or speeches, however, go into the question of whether there actually is a shortage of scientists. Most take it for granted, and it was to find out the facts that we undertook an investigation into the scientific recruiting of several large chemical firms and institutions. The results are, to some extent, surprising.

Let us take the chemists first. A glance at the advertisements for scientific staff in any technical or daily paper will reveal one striking common feature. Two-thirds of all the advertisements for chemists require men between the ages of 21 and 35, with roughly half of these setting an age limit of 30 or under. The fact that these advertisements appear for one, two, of very occasionally, three weeks in succession, indicates that the vacancies are filled satisfactorily in that time. It is obvious that if industry is able to satisfy its demands for chemists with the age groups under 35, it has not yet reached the bottom of the reservoir.

Inquiries made through the appointment registers of various training colleges and scientific bodies confirm this impression. One or two years ago employers were very quick to employ chemists where they could find them, without worrying too much about the fit. Nowadays it is very much more difficult for a man with only a Pass degree to find a job, and older men are finding their age a handicap. The reluctance to employ older men is, of course, due to the additional expense involved when a man over 35 enters a superannuation scheme. Some firms are starting scientific training schemes for their employees, and these provide some openings for the older chemists, but, generally, these men are affected by the universal difficulty facing the older generation trying to find jobs. Chemical industry is not yet sufficiently starved of manpower to absorb them all.

Most employers in the chemical industry agree that the supply of chemists is fairly adequate. Given time, the right applicant can be found for the right job. Most big firms want young graduates either straight from a university

or after a few years research, with a view to training them up to fill, eventually, the senior posts in the company. Many rarely have to advertise for senior men for this reason, which explains the preponderance of age limits in advertisements. Firms needing young men interview students at the universities before they go down, and except for poorly qualified men, these are rarely on the market for long. One explanation of the relative abundance of chemists now may be the fact that the batch of National Service men entering the forces two years ago have recently been demobilised. A proportion of these are chemists who were called up immediately they graduated.

In the field of chemical engineering the outlook is quite different. The output of chemical engineers in this country is 200 per annum. In the U.S.A., where the chemical engineer is looked upon as the key figure in chemical industry, it is 3,000-4,000 per annum. The low figure for this country is reflected in the advertisement pages. Out of every 100 advertisements for chemists there are a mere six advertisements for chemical engineers. Few, if any, of these, state any preference for age.

The reasons for this apparent lack of demand are several. Firstly, firms have stopped advertising for chemical engineers because they get no applicants. In the second place, chemical engineering in this country has still a long way to go before it attains full recognition. There is ignorance at both ends of the production line—widespread ignorance in industry of the value of the chemical engineer, and equal ignorance in the schools about the existence of chemical engineering as a career. Most headmasters are classical men, with a corresponding bias towards the classics, and their ignorance even of the existence of such a hybrid as the chemical engineer is sometimes complete.

Yet another factor which prevents students from taking up chemical engineering is the fact that scholarships rarely cover the extra year required after reading chemistry to do a post-graduate course in the subject, although of course they cover the ordinary 4-year degree course in chemical engineering. The starting salary for a chemical engineer is only £650 after he has done this post-graduate course, so the financial incentive is not great. With present chemical expansion, however, the demand for chemical engineers is increasing. Somehow the supply will have to be increased with it, or expansion will suffer.

The adequate supply of chemists in this country compared with the totally inadequate number of chemical engineers may explain to some extent our reputation for producing great results in pure science, only to leave it to others to exploit these results to their own advantage. The lesson would seem to be that we need further recognition of the chemical engineer as a specialist in his own right, and the added incentives which would follow for the student or the chemist to take up the subject.

On Other Pages

The annual subscription to THE CHEMICAL AGE is 35s. Single copies, 9d.; post paid, 1s.; SCOTTISH OFFICE: 116 Hope Street, Glasgow (Central 3954/5). MIDLANDS OFFICE: Daimler House, Paradise Street, Birmingham (Midland 0784/5). THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited.

Notes & Comments

The Significance of Sodium

A FEW days ago Dr. J. J. Lehr, whose original papers on sodium in plant nutrition are well known, visited London and read a general paper on this controversial element to the Agriculture Group of the SCI. There are not many soil scientists or plant physiologists who would not today admit that there is 'something in this sodium business'. Dr. Lehr's new paper has crystallised that 'something'. In all fields of expanding knowledge the first phase is confused, and rapid advance based upon clear understanding is rarely possible until the foggy atmosphere has been dispersed. Usually a clear and simple thesis or theory, probable if not actually established, is the turning-point between dusk and light. Dr. Lehr put forward a most simple conception of the plant-feeding functions of sodium, and this may well prove to be the turning-point for this persistently difficult problem in plant nutrition. It has always been controversial whether sodium merely acts as a substitute for potassium or in its own right as a plant nutrient. The evidence for a few crops has certainly given sodium its own status—for sugar beet, fodder beet, and mangolds the yield-enhancing virtues of sodium are now widely admitted. But with most other crops studied opinions tend to be divided whether responses to sodium are genuine or merely reflections of a need for potassium that sodium can partially satisfy.

A Major Step Forward

DR. LEHR'S theory or working hypothesis first considers the plant's requirement of univalent cations as a whole. This requirement may be divided into three parts—first, a part that can be met only by potassium; second, a part that can be met by either potassium or sodium; and third, a part that can be met only by sodium. For different species of plants, the proportionate sizes of these three parts will be different. For some species, the physiological functions that only sodium can fulfil may be quite small; for others, such as sugar beet, that part may be relatively large. Experimental work to assess the crop-increasing properties of sodium must be designed with this basic idea in mind; similarly, the results of experiments of the past should be reviewed in its light. Already Dr. Lehr has been able to classify many farm crop plants into groups that follow the obvious variations of this theory. It is, when stated, a simple enough conception but we believe Dr. Lehr is the first to put it forward so clearly. It enables much of the inconclusive work in the agricultural literature of sodium to be explained and this alone is a major step forward.

Deserves Close Study

IN this country we have every reason to study this subject closely. Sodium is abundantly and cheaply available in the form of salt. In Dr. Lehr's own country much of the best farming soil is originally saline and therefore well stocked with sodium reserves. Here sodium deficiencies in farm soils are much more likely to occur. The agriculturists of 150 years ago believed very strongly in salt for major crops and for grassland. Even with the development of modern fertilisers sodium was considerably used—nitrate of soda from Chile brought sodium with its nitrogen and low grade potash materials contained high proportions of salt. When these materials were more extensively used, sodium was being unconsciously supplied to crops but getting none of the credit for the resultant yield increases.

Indium Advances

WHEN Murray in America set out to develop uses for indium, it took several months before his initial order for indium was met—with a single gram which had been gathered together from several sources. That was in 1924. Thanks mainly to Murray's pioneering work, a range of uses or potential uses became known—notably

in aircraft and racing car bearings, low melting-pointing alloys, and plating. However, indium has remained a scarce metal if not precisely a rare one. Annual production in the United States is said to be approximately 500,000 ounces selling at about $2.25 an ounce. Indium is present in many zinc ores and its production is mainly based upon recovery from zinc smelting by-products. It has also been recovered as a by-product from lithophone manufacture. According to a news report in America (*Chemical Week*, 1952, **71**, 20, 52) Canada may shortly enter the indium production field on a scale that dwarfs all previous ventures. A new process, details of which have not been made public, has been developed by the Consolidated Mining & Smelter Co. of Canada, Ltd. It is an electrochemical, electrolytic process and is applied to indium that concentrates in dross from the lead smelter. 99.95 per cent purity is being achieved on a pilot-plant. As soon as new uses build up an attractive enough demand, the Canadian firm will produce up to 35 tons per year of indium, considerably more than twice the present volume of world production.

The Stanlow Story

Film Record of a Great Achievement

FOUR years 'on location' is a record which must be admired, but which few film units would care to emulate. Yet this was the time taken by the Shell Film Unit to trace the 'Stanlow Story,' and show how a piece of barren marshland is now the site of one of the world's most modern oil refineries.

'Stanlow Story,' a black and white film running approximately three-quarters of an hour, was shown recently at the Royal Empire Society Theatre, London, to shareholders and Press representatives.

When the refinery was planned it was decided to make a film record of the entire construction of the refinery. It was not intended to show the technical features of the refining process, nor even the detail of the building of every plant. The object was rather to convey an impression of the magnitude of the project itself and of the immense labour both of the technicians who planned and supervised the work and of the men on the job.

How successfully this has been carried out under the direction of Mr. Douglas Clarke is reflected in the spirit of enterprise and achievement which pervades the film.

Work was all arranged to schedule and so could not, of course, be interrupted. Nothing could be 'staged' and all the shots had to be taken as and when any event happened, wherever it was and whatever the conditions.

Day and night, hot or cold, mist or sunshine, swinging high in the air in the bucket of a crane, or working in a tunnel underground, members of the film unit, ever watchful, were always on the spot when any important stage was reached.

The new refinery was planned in four phases, with one major plant with its necessary ancillaries, coming into operation at the end of each phase. This is shown in some detail in the film as also are some of the major tasks that were essential to the erection of the great plants themselves.

Many miles of roads and complicated systems of pipe-lines had to be laid; a tunnel 1½ miles in length had to be dug for the water cooling lines; and a three-level underpass had to be built beneath a busy railway.

There are many dramatic shots and fleeting impressions that remain in the memory. A glimpse of men on the ground, seen through a hole in a portion of the 'cat. cracker' during the process of erection; the tense watchful face of a workman as an absorber column weighing 240 tons and over 170 ft. long was raised into the vertical position; the two solitary surveyors on the marshy ground in the mist and cold at the beginning of the film, in contrast to the crowds of cheery workmen tramping along a newly-made road at a later stage; the smile of satisfaction which spread from watcher to watcher as the first water flowed through into the cooling tower; and finally, the anxious scrutiny of the hundreds of delicate instruments as the £8,000,000 catalytic cracking plant was brought 'on stream.'

Gelatine & Glue Research

Practical Questions Discussed at Panel Meeting

THE sixth meeting of the Research Panel of the British Gelatine and Glue Research Association was held at Beale's Restaurant, London, N.7, on Thursday, 27 November. Mr. S. G. Hudson (Richard Hodgson & Sons, Ltd.) chairman of the Association was in the chair. The meeting was attended by persons representing member firms, research associations, Government laboratories, etc. The meeting was the first at which practical questions of the main processes were the subject of the papers, and representatives of a number of industrial plants attended by invitation.

The first paper was given by Dr. W. E. Braybrooks, of Messrs. Stokes & Co., Ltd., with the title 'Tannery Treatment of Pieces and Fleshings.' Dr. Braybrooks described the tannery processes which precede the despatch of waste material, pieces, split hides and fleshings, to the gelatine or glue works, and outlined the reasons for the use of different types of process. He outlined the effect on the hide of short dehairing processes using strong sulphide solutions in addition to lime, as compared with the slower acting lime treatments which may have small sulphide additions. He also considered the use of drum dehairing and liming in comparison with pit liming, with or without agitation. The discussion was opened by Dr. W. M. Ames (J. & G. Cox, Ltd.) and the vote of thanks was proposed by Mr. J. N. Blake (Richard Hodgson & Sons, Ltd.) and seconded by Dr. G. Stainsby (BGGRA).

The Extraction of Hides

The second paper, 'The Extraction of Hides' by Mr. D. Fysh, of the Association's staff, described small-scale experiments on gelatine production. The principle variables considered were period of pretreatment of the raw material with lime suspensions, time, temperature and *p*H of extraction, solid/liquid ratio in extraction and the effect of added salts. In each instance rate of extraction and the quality of the product were determined. The method of extraction followed the works process in carrying extraction virtually to completion, by using five successive operations of increasing severity. In this, the work was an advance over the earlier investigations of R. H. Bogue and W. M. Ames. The discussion was opened by Mr. C. F. C. Simeons (British Gelatine Works, Ltd.) and the vote of thanks was proposed by Mr. D. T. Bruce (Thomson Bros. (Birkenhead), Ltd.) and seconded by Mr. I. Norvick (Bristol Manufacturers, Ltd.).

Bones Processing

The third paper was by Mr. D. B. Hall, of Messrs. John Knight, Ltd., and was entitled 'Bones Processing.' Mr. Hall commenced by describing the nature and mode of collection of the industry's raw material. He then followed the process stage by stage to the point at which the dilute glue liquors are ready for evaporation. At each stage he commented on the method of operation of the plant and on the problems which arise. The discussion was opened by Mr. A. G. Ward, Director of Research of the Association, and the vote of thanks was proposed by Mr. E. H. Moore (Alfred Adams & Co., Ltd.) and seconded by Dr. E. C. Jones (Harris Lebus, Ltd.).

The final paper by Dr. E. M. Vyner, (Messrs. Sheppy Glue & Chemical Works, Ltd.) described the evaporation and drying of gelatine and bone glue liquors under the title 'Aspects of the Evaporating and Drying Process in the Glue and Gelatine Industry.' Dr. Vyner outlined the principles of drying and discussed the main actual and potential methods of going from a dilute gelatine or glue solution to the dry material. These included spray drying, freeze drying, single and multi-effect evaporators with or without thermal recompression, low temperature (ammonia) evaporators, the various means of producing subdivided jellies for the final stages of drying, and drying tunnels or batch dryers. The ideal was stated of a single economical process giving a conveniently sized end-product for use. No process at present in operation conforms entirely to this ideal. The discussion was opened by Mr. W. H. Bickle, of Intelligence Division, Department of Scientific and Industrial Research. The vote of thanks was proposed by Dr. P. G. Bourne (B. Cannon & Co., Ltd.) and seconded by Mr. G. F. Hubbert (Ross Gelatines, Ltd.).

At the Association's annual general meeting, which was held on 26 November at the Waldorf Hotel, London, Mr. G. W. Odey, C.B.E., M.P., chairman of Messrs. Barrow, Hepburn & Gale, Ltd., was re-elected president of the Association. The chairman, Mr. S. G. Hudson, of Messrs. Richard Hodgson & Sons, Ltd., in his remarks concerning the annual report, outlined the progress made since the Association was formed. He commented on the expansion of work on user problems now taking place and expressed the hope that increased co-operation with user firms, through associate membership, would be secured in the forthcoming period. The Director of Research, Mr. A. G. Ward, discussed relations between member firms and the association's staff and emphasised the conditions necessary to secure fruitful work. Sir Roger Duncalfe, chairman of British Glues & Chemicals, Ltd., who proposed a vote of thanks to the Council and staff of the Association, paid tribute to the past work and stressed the responsibilities which fall on the industry in giving guidance to the Association concerning the relation of the research programme to the needs of the industry.

Symposium on Bursting Discs

'BURSTING Discs' will be the subject of a symposium to be held in London on Tuesday, 13 January, by the Institution of Chemical Engineers, when the chair will be taken by the president, Mr. Stanley Robson.

According to the provisional programme the meeting will be in two sessions, the first from 3 p.m. to 5 p.m., followed by a tea interval, and the second from 6 p.m.

Mr. T. B. Phillip (Member), will open the symposium with a paper on 'The Use of Ductile Metals for Bursting Discs,' and he will be followed by Mr. D. J. Breeze (Associate Member) who will discuss 'Bursting Disc Design and Its Application in the Chemical Industry.'

'The Design and Operation of Bursting Discs in Isolating,' will be described by Mr. F. Molyneux (Associate Member), and the meeting will then be thrown open for discussion until the break for tea.

In the second session, there will be two papers. Mr. E. A. Patrick (Associate Member) will speak on 'Bursting Disc Assembly for Alternating Pressure and Vacuum at Elevated Temperature,' and 'The Design and Manufacture of Bursting Disc Assemblies' will be dealt with by Mr. J. M. Pirie (Associate Member) and Mr. J. Brown.

Acetic Acid Prices Fall

THE prices of all grades of acetic acid have been reduced with effect from 1 December. A. Boake, Roberts & Co., Ltd., have lowered the price of their glacial grades by £12 per ton, and their 80 per cent grades by £10 per ton, and British Industrial Solvents, Ltd., have introduced similar price reductions. The revised prices for BISOL acetic acid are as follows:—

Glacial B.P. £111 per ton; glacial 99-100 per cent £108 per ton; glacial 98-100 per cent £105 per ton; 80 per cent pure £102 per ton and 80 per cent technical £96 per ton. All prices quoted are for 10-ton lots spot or contract.

British Industrial Solvents have also reduced the price of their dioctyl phthalate plasticiser—Bisoflex 81, by 3d. per lb. The new price schedule for this product is as follows:—

Ten tons spot or contract 2s. 10d. per lb.; 5 tons spot or contract 2s. 10½d. per lb.; 1 ton lots spot or contract 2s. 10¾d. per lb.; 45 gallon drum 2s. 11½d. per lb.; 10 gallon can 3s. 1½d. per lb.; and 5 gallon can 3s. 2½d. per lb. All prices are carriage paid, in returnable packages.

BISOL Dibutyl Phthalate

The price of dibutyl phthalate has been reduced by British Industrial Solvents, Ltd., by 2½d. per lb. and the new schedule of prices given below took effect on all despatches made on and after 8 December:—10 tons spot or contract over six months, 2s. 3d. per lb.; 5 tons spot or contract over six months, 2s. 3½d. per lb.; 1 tons spot or contract over six months, 2s. 3¾d. per lb.; 45 gallon drum, 2s. 4½d. per lb.; 10 gallon can, 2s. 6½d. per lb.; 5 gallon can, 2s. 7½d. per lb. The allowances on 5 ton lots in drums in one delivery will be £1 per ton and in road tankers £2 per ton.

All prices are carriage paid, packages extra and credited in full on return in good condition, carriage forward.

Printing and Packaging Research

Examples of PATRA'S Work on View

PACKAGING and printing are two craft industries closely associated with the chemical and allied trades. In its wide range of products the chemical industry probably utilises a far greater variety of packages and containers than any other, while many of the chemical concerns are involved with printing in one form or another.

The valuable work carried out by the Printing, Packaging and Allied Trades Research Association under its director of research, Dr. G. L. Riddell, F.R.I.C., was referred to by Sir Wallace Akers, C.B.E., F.R.S., director of Imperial Chemical Industries, Ltd., responsible for research, in his speech at a luncheon which followed the annual general meeting of the Association held in London on Thursday, 4 December.

Profitable Investment

Research, properly carried out, said Sir Wallace, could not fail to be a profitable investment. While it was important that as much help as possible should be given to member firms in their day-to-day problems the really valuable research was fundamental and usually a long-term project.

Patience and perseverence were essential, new inventions were seldom discovered by flashes of inspiration. Only by having complete confidence in the director of research and giving him the widest possible powers, could the best results be obtained.

Colonel J. J. Astor, whose four-year term as president had just ended, and who was elected vice-president, thanked Sir Wallace. He said that during the war Sir Wallace Akers, when in charge of the British effort on production of the atom bomb, had established contact with the printing industry and the association. This had arisen because it was found that printing techniques and research could make a contribution towards the solution of some of the technical problems involved in the production of the required isotopes of uranium.

Referring to the new laboratories at Leatherhead, Mr. G. L. Tillotson, chairman, said that donations to the Building Fund, together with the corresponding grant from the Department of Scientific and Industrial Research, had met practically 90 per cent of the expenses involved, so that the reserves which first guaranteed this project had been largely replaced, and finances were again on a firm foundation. The chairman also gave some account of his recent visit to the U.S.A., and mentioned the high esteem with which PATRA was regarded abroad.

In connection with its annual general meeting an exhibition was again held to demonstrate some of the work being undertaken by the association.

Printing Exhibition

The nucleus of this year's display was a travelling exhibition on printing which has already been seen in Birmingham, Bristol, Cardiff, Hastings, Leeds, Manchester, Nottingham, and Oxford, and will later be taken to Scotland. Other sections covered a variety of packaging hazards, general information and inquiries.

An improved material, Patracoat, for making albumen photolitho plates had been developed during the year, and was shown among the photo-mechanical processes. It is a single solution already sensitised, which will keep for several months without deterioration. In addition to its technical advantages, it is a British product, whereas albumen is a hard currency import. The material has had extensive works trials and is now being widely sold.

Ink-drying difficulties formed a high proportion of the inquiries received by PATRA during the year. An instrument for determining the drying time of inks on paper had been completed and was on view.

In the books section it was found that difficulty was frequently encountered in securing good adhesion of end-papers to the turn-ins of nitrocellulosed coated cloth covers. Although satisfactory adhesion can be obtained with special adhesives, these are somewhat more expensive than those normally used. Successful tests have been carried out on a 'Rexine' with a special finish developed by I.C.I. (Leathercloth Division) and the manufacturers have now agreed to make this special 'Rexine' available for bookbinding, in the near future.

Work on the treatment of bookbinding

material such as cloth and paper with materials which inhibit insect and mould attack was continued.

There were a number of materials which were effective, but their commercial application was rendered difficult having regard to cost, method of incorporation and quantity required. All these considerations raised difficult technical problems.

Thus in the case of phenyl mercury fixtan (which earlier work had shown to be an effective fungicide) the efficiency of its retention by the paper during treatment affects the initial quantity required. Furthermore, the material is toxic and a satisfactory method of incorporating the material in paper had not yet been established.

Work on this aspect of the problem was proceeding in co-operation with the British Paper and Board Industry Research Association. Because of the toxicity of the mercury compounds, attention was diverted for some time to a non-toxic inhibitor—dihydroxy dichloro-diphenyl methane—but its use was not promising on account of its high cost.

Treatment of Books

Although the work was still not in the stage where definite specifications could be laid down for the full treatment of books against both insects and moulds, as an interim measure advantage was being taken of an offer by the Ministry of Supply Field Station in Nigeria to test bookcovers which had been treated by hand application. The work was proceeding only slowly because the books (some 300) were being hand-treated in these laboratories.

New methods of treating bookcovers with varnishes containing DDT developed by the Colonial Office Research Unit were being closely followed.

During the year some 58 inquiries dealing with mould and insect attack and the efficiency of fungicides have been undertaken.

Specimens of book damaged by termite bookworm and cockroach were displayed.

Many of the coloured pigments and dyestuffs used in inks, papers and bookcloths are not fast in acids, alkalis or chemicals such as sulphur dioxide, which is common in glue. Examples were shown of the fading of bronze blue caused by the sodium silicate used in lining a boxboard and the fading on the spine of a book caused by a hot glue containing 6 per cent sulphur dioxide.

In the packaging division, PATRA's research programme had been devoted to studying the various factors in the design and construction of containers which control their strength, and the degree of protection they give against mechanical damage.

An impact recorder had been designed which measured the heights and the number of drops which a package suffered on a journey by road or rail.

Similar impacts could be reproduced in the laboratory by a prototype equipment devised to record the intensity and nature of shock received by goods when dropped or vibrated in experimental packages. An accelerometer was attached to an article in the package, or to the container itself, and a record was obtained on a cathode-ray tube of the shock pulse occurring when the package was dropped or vibrated. The 'trace' on the tube when photographed would show the effect on the article when packed in solid wood, corrugated board, sponge rubber or other materials.

Experience had shown that the standard paper tests (bursting strength, tensile strength and resistance to tear) were inadequate for the evaluation of the strength of papers for bag making.

Drop tests on filled bags carried out in laboratory tests were shown to correlate well with the behaviour of bags in practice. This work had been extended to ascertain:

(1) The influence of the type of paper, the basic weight of the paper, the style of the bag, and the weight and nature of the contents on the performance of the bag as measured by laboratory drop tests.

(2) The relationship between the performance of the bag and methods of measuring the strength of the paper.

Uganda Wolfram Deal with U.K.

A buying offer by the United Kingdom Ministry of Materials has been accepted by all the main wolfram producers in Uganda. An arrangement has been made between the Uganda Government and the Ministry under which the U.K. Government will, for five years, purchase wolfram produced in Uganda. The price will be that prevailing in the London market, subject to a minimum of 250s. per unit, delivered London. The present world price of wolfram is 410s. per unit, c.i.f., U.K.

Recent Progress in Refinery Flare Stack Design

COMBUSTIBLE refinery gases which cannot be usefully processed are usually disposed of by burning. Inspection of many flaring installations shows that surprisingly little thought has been given to proper design and location of these units, at least until recent years. Growing safety and a consciousness of public relations on the part of refinery management has of late resulted in the development of sound engineering bases which may serve as guides in the construction of flare stacks. With today's knowledge at hand, supported by a bit of on-site engineering ingenuity, it is possible to provide flares which are satisfactory from the point of view of fire safety as well as that of minimised air pollution, a factor of rapidly growing importance in many communities.

A primary factor is the selection of a safe location for the flare stack. The open flame represents a rather obvious hazard to process and storage equipment, and sufficient distance must be provided from combustible materials. There is a relation between the height of the stack and its distance from danger spots in the refinery. While it is feasible to operate at a point near ground level, this will require distant isolation of the flare stack, not only to prevent undue proximity of an open flame to plant equipment but also to minimise the danger of accumulating large concentrations of combustible gas at ground level in case of flame failure.

API Recommendations

Flare stacks within 500 ft. of process equipment are best held at a minimum height of 100 ft. Even then, the American Petroleum Institute recommends that they be at a distance of not less than 200 ft. from any storage tank of more than 50,000 gallon capacity, containing flammable material. The distance from any other type of operating unit (handling flammable materials) should not be less than 100 ft.

Wind and ground contours play a part in siting flare stacks. In spite of the useful re-lighting devices now on the market, there is always a possibility that the flame may be extinguished for some time, when gas from the stack will tend to settle downwards. For the stack to be in a hollow then would create a most hazardous situation due to the danger of an explosion.

Safety Records Studied

Armistead has studied the safety records of a number of refineries in which, due to limited available space, combination cracking units have been operated with the blowdown drum and flare stack located directly adjacent to them. He has found that a reasonable standard of safety was maintained in instances where ample liquid separation volume is provided (for blowdown purposes) and where effluent vapours are carefully discharged to the air accompanied by diffusion steam at least 50 ft. above ground. An equally acceptable safety record is reported in the case of light hydrocarbon vapour blowdown drums set directly on top of catalytic cracking units. Here, too, adequate diffusion steam must be provided.

Typical flare stack design calls for the use of high-temperature alloy in the uppermost 20-30 ft. A flame arrestor should be provided along the path of combustible gas travel to minimise the danger of back-flashing into a possibly explosive mixture further upstream. Proper precautions must be taken to prevent freeze-up of this equipment. A slightly positive pressure can be maintained at the top of the flare stack by the injection of steam or bleed gas at this point. This will prevent the entry of air into the stack. A suitable ignition device (pilot flame or electrical—see below) is provided at the top of the stack to initiate flame immediately after it has been extinguished for any reason.

Much of the foregoing knowledge has been incorporated into refinery design for many years. Flares have been operated successfully, frequently with good safety records and—not so frequently—with low smoke formation. The innovations due to engineering research into this field now promise to improve this record statistically.

An important contribution along these

lines is due to Esso Standard Oil Company's (experimental) steam injection technique which promises to assist significantly in the polution of smoke abatement problems. Typical is the installation at Esso's Bayway, N.J. refinery, as described by Smolen. Here, steam is injected through an open pipe into the centre of the stack, about 24 in. below the exit plane (of a 20-in. dia. stack). This simple expedient can serve to reduce a formidable flare smoke problem to virtual non-existence.

Smolen reports that, for a waste gas stream of which approximately 8.5 per cent of the combustible components are (smoke-forming) unsaturates, fully satisfactory results could be achieved by the injection of 0.25-0.40 lb. steam per lb. of combustible material. The amount of steam must be boosted as the concentration of unsaturates is increased.

Explanation for Improvement

An explanation for this striking smoke and flame improvement due to steam injection must be sought (a) in the reduction of polymerising conditions which will lead to carbon formation and (b) in the pre-oxidation of hydrocarbons (especially of the unsaturated type) to compounds which burn at a reduced rate and at temperatures not conducive to cracking and polymerisation.

There are alternative schemes which will, at least in part, serve the same purpose. These include (a) the use of air injection—an approach which is frequently economically unsound, and (b) inspiration of the gas to be burned through a Venturi-type arrangement (thus promoting a primary-air system of the type used in the Bunsen burner). This second approach requires, however, that the flare gas be available at pressures sufficient to effect the inspiration of the required amount of air. Such pressures are rarely available in refinery waste gases.

These considerations have led Shell Oil Company's Dominguez refinery to deal with its smoke abatement problem by selecting a technique of steam injection similar to that described above for Esso's Bayway plant. In the case of Shell, however, the problem was further complicated due to the limited available quantity of steam. It was found that most economical steam usage could be obtained when the steam was discharged at the top of the flare through a ring of jets. Be it noted, however, that—according to an article by L. D. Cleveland—smoke reduction in this system was appreciable but not fully satisfactory.

As used at Dominguez, the steam injection serves the simultaneous secondary purpose of drawing in primary air into the flame area. This calls for high-pressure steam, and 140 p.s.i. is employed. Gas is being burned at the rate of 150,000 cu. ft./hr. with a corresponding steam consumption of 6,000 lb. Information on the degree of hydrocarbon unsaturation is not available.

Refineries fortunate enough to have their waste gas available at pressure may utilise the very effective Venturi-type flare for the elimination of smoke. A case in point is an installation by General Petroleum Corporation on which information has recently become available. Here, the waste gas itself serves to draw primary air into the system. The amount of air which must be drawn in (and which is determined—for any given flow rate—by the ratio of Venturi throat diameter to stack diameter) is directly related to the amount of unsaturated and liquid hydrocarbons present in the stream entering the flare stack. In the case of General Petroleum Corporation's installation, it was found necessary to use an 8: 1 Venturi ratio for wet waste gas, while for pure *iso*butane a ratio of 4: 1 would be adequate.

Such a system must be operated above a critical minimum pressure below which there is a tendency for the flame to flash back. This pressure is probably below 1 p.s.i.g., but —for reliably stable conditions at fluctuating feed rates—pressures around 3 p.s.i.g. are occasionally called for. General Petroleum Corporation's system is designed for a maximum pressure of 5 p.s.i.g.

Serves Secondary Purpose

A Venturi system of this type (or of the steam-injection type used by Shell Oil Co.) serves a useful secondary purpose. Air drawn into the system may be passed along the hottest part of the stack and thus provide a cooling effect for metal protection. Indeed, by applying this scheme, and protecting the burners from radiated heat, General Petroleum Corp. has found it possible to use fabricated steel Venturis.

Standard Oil Co., of Ohio, has been able to overcome severe limitations encountered due to coking and smoke formation in a high-capacity flare stack by the use of a

special flare tip. In this system, primary air is injected into an Inconel sleeve surrounding the top of the stack. The air is introduced via a number of upturned nozzles; i.e., the flow is in the same direction as that of the gas and pressure drop is thus minimised.

The use of compressed air would result in excessive cost. An economical solution to the air supply problem was, however, found in the use of a Maxon gas burner jet, using steam for primary air inspiration. The use of such units calls for the use of only 1 cu. ft. steam per 10 cu. ft. gas.

A Maxon burner serves Standard Oil also as a 'windproof' pilot light in the flare stack. High-pressure gas is fed to a 1½-in. Maxon burner and primary air is introduced along the path. The combustible gas-air mixture is carried by an alloy tube to the top of the flare stack where a stable pilot flame results.

Reliable Ignition Source

The entire problem of a reliable ignition source for flare stacks is so far only in an advanced phase of solution, a universal means is not yet at hand. Numerous manual means of relighting, depending on flame propagation, have been used in connection with the commonly employed gas-air pilot flame. Mechanical means for carrying a burning torch to the top of the flare stack have been used. Most of these methods are of limited reliability and some are, in addition, quite cumbersome. Electrical sparks have found widespread favour, but difficulties due to soot formation, insulation difficulties, etc., have not been overcome.

A useful and safe device recently patented by Humble Oil & Refining Co. is being used at this organisation's Baytown, Texas refinery. In essence, the pilot gas flame is provided with a relighting device in its own turn. This is a manually operated small line, carrying a combustible gas-air mixture to the pilot flame at the top of the stack. About 10 ft. before it reaches its destination, this mixture is ignited by a low-voltage electrical heating element. The resulting flame re-lights the pilot flame. The secondary pilot is then cut off. This system eliminates the possibility of explosion due to accumulation of a combustible mixture at the stack bottom. Furthermore, the use of a low-voltage electrical ignition system obviates insulating difficulties.

U.S. Chemical Expansion

No Over-Extension Considered Likely

CONTINUED progress and development of the American chemical industry was forecast by three of the nation's most prominent chemical leaders in industry and government in a nation-wide broadcast delivered recently over the ABC network in a programme entitled 'Production Report.'

The speakers were Dr. George E. Holbrook, former head of the chemical division of the National Production Authority, and two representatives of the Manufacturing Chemists' Association, Dan M. Rugg (vice-president and general manager of the chemical division of Koppers Co., Inc.) and Dr. Robert C. Swain (vice-president of the American Cyanamid Co.).

Expansion of chemical-producing facilities in the U.S.A. during the past two years had been without parallel in the nation's history, declared Dr. Holbrook. The industry's four-year programme, which would result in expenditures exceeding $5,000,000,000 by 1955, was second only to the expansion plan of the steel industry.

The chemical industry, continued Dr. Holbrook, was, in his opinion, definitely better prepared to grapple with difficult technical problems, and world leadership in chemistry and chemical engineering was now really a keystone in the industrial strength of the U.S.A. Besides the requirements of the defence programme the industry was providing the new chemical plant essential to bring to the public the improved products of chemical research.

Dr. Swain saw no reason for expecting the present rate of expansion in chemicals to stop. Prophets who had said that the industry was overextending itself were wrong in 1946, and they would be wrong again, he predicted. The chemical industry must be dynamic to survive.

Development of the chemical industry in the U.S.A. really began during the first world war when imports of chemicals from Europe were cut off, said Mr. Rugg. World War II had greatly accelerated the requirements for chemicals and laid the foundations for much of the present growth. The industry had now met all the requirements of the present defence programme, he declared.

Instrumentation at Coryton Refinery

Water Treatment Plant Approaches Completion

INSTRUMENTATION in a modern oil refinery is only second in importance to the design of the actual refining plant. At the Vacuum Oil Company's new refinery at Coryton, on the Essex Bank of the Thames, 25 miles from London, the Lummus Company, the contractors building the plant, have specified instruments by a British firm, Bristol's Instrument Co., Ltd., of Weymouth.

The contract covers recording, controlling, indicating, transmitting and integrating instruments for the water treating plant, the propane de-asphalting unit, the furfurol unit, the gasoline treating plant, the MEK dewaxing unit, turbo-generators and a large number of off-site instruments such as those recording the supply of city water to the refinery, and four transmitter recorders controlling the intake of cooling water from the Thames—about 82,000 gallons a minute.

Water Treating Plant

First unit to approach completion is the water treating plant which is capable of handling 100,000 lb. of city water an hour. There are two lime softeners, one of which is normally used as a standby.

The condensate return is re-circulated to the softeners and a recording and integrating flowmeter maintains a continuous check on the make-up water to the softeners. Most of the lines and the associated equipment from the lime softeners are duplicated to ensure continuity of operation under all circumstances.

From the lime softeners the flow is transmitted from two local instruments to a two-pen recording flow receiver on the control panel. Integration of the total flow is also included. The integrator time impulse cam unit is housed in the transmitter case and the reading is transmitted over a pair of lines to the integrator totaliser unit mounted above the two-pen receiver on the control panel.

Flow to each of the Zeolite softeners is measured and controlled by six local indicating pneumatic proportional plus integral controllers which are equipped with pneumatic remote control point setting mechanism. These control points are remotely adjusted according to the level in the surge tank. In addition, these six controllers are equipped with pneumatic transmission systems and continuously transmit the reading of actual rate of flow to a pair of three-pen recording receivers on the control panel.

There are two flow transmitters transmitting the rate of flow of treated water from the Zeolite softeners to the treated water storage. Again these are transmitting pneumatically to two recording receivers on the control panel with separate integrator totaliser units mounted above.

For re-generation, the rate of flow of rinse water to the Zeolite softeners is automatically controlled by a local transmitter with a recording receiver flow controller and integrator on the control panel. Similarly, the rate of flow of water from the Zeolite softeners to the back settler is automatically controlled by a local transmitter with recording receiver controller and integrator on the panel. The wash water flow rate to the Zeolite softeners is transmitted locally to a recording integrating receiver on the control panel.

Condensate return to the water treating plant is again recorded and integrated by local transmitters and control room receivers.

Steam usage at the water treating plant for pumps, pressurisation, and so on, is recorded and integrated by local transmitters and two-pen receivers and separate integrator totalisers. The pressure in the back wash settler is automatically controlled from the panel by a recording air-operated controller. Other factors recorded in the control room include back wash level city water pressure, city water storage tank level, which is automatically controlled.

Fatal Explosion

Six people are known to have been killed in an explosion followed by a fierce fire at the Pure Oil Company's refinery at Nederland, near Port Neches, in the heart of the huge petroleum refining and petro-chemical industry along the Texas coast. The blast is believed to have occurred in a catalytic cracking plant for processing oil.

Gamma-Radiography

Progress in Non-Destructive Testing

by Dr. H. Manley

A RECENT failure of a large piece of equipment at a newly-built oil refinery can be blamed, at least in part, to lack of testing by radiographic technique, which is a relatively reliable and simple way of non-destructive testing.

It is well known that X-rays developed by electrical means, and γ-rays from elements produced in atomic piles, are capable of penetrating most industrial materials and of producing pictures on X-ray films of the internal structures of materials, such as castings, welded joints and all the conditions pertaining within certain kinds of assemblies.

Dangerous welding faults can be detected by radiography and errors of technique, particularly on the part of welders, can be corrected with resultant saving of material and costly breakdowns. Economies in materials and man-hours can be based upon information of internal structures obtained by radiography. Internal defects in castings can be discovered before costly machining or final assembly is carried out and a whole production batch of castings, for example, can be put in hand with a certain knowledge that the production will not be interrupted by hidden casting defects.

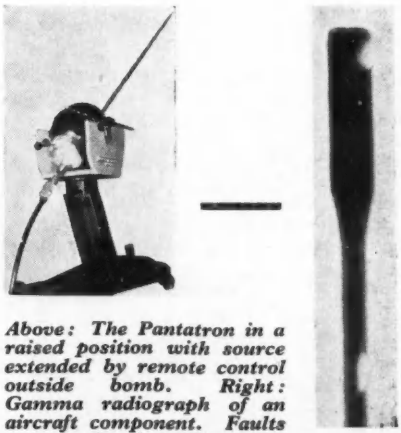
Prevention of Breakdowns

Many a chemical and oil refining plant has to be radiographed at potentially dangerous spots in order to prevent, or safeguard against, costly breakdowns. The competitive market in all types of equipment puts increasing demand on safety and reliability and is forcing conservative manufacturers to adopt modern methods of non-destructive testing, of which industrial radiography is the only one to provide a permanent record. It is cheaper to have 60 or 80 radiographs at 1s. to 4s. each than to risk a breakdown of which the smallest is more expensive.

X-ray methods for this type of inspection have been accepted and used for some 20-25 years. In the 1930's there were six X-ray sets for such inspection in the U.S.A.—the number rising to 48 by 1936 and 88 by 1939. It seemed incredible when, twelve years later, Dr. Seiffert, a German manufacturer of X-ray plant, mentioned at his lecture in the Institute of Physics in London that the number of X-ray sets in German industry in 1945 was over 3,000, having a probable value of several millions pounds.

In this country, the standard practice for years, in boiler-making and in virtually all pressure vessels, has been to provide an X-ray picture of welds. The British Standards Institution and Lloyd's have their specifications in this field.

Industrial radiography has until recently been carried out almost entirely with large and very costly machines, the X-rays being produced by electrical means. Only a very large volume of work has been able to justify the capital and maintenance costs of the orthodox X-ray installations, which are, therefore, uncommon in industry. Gamma-ray inspection can be conducted by relatively inexperienced operators using robust, low-priced apparatus, providing permanent inspection records at low costs.



Above: The Pantatron in a raised position with source extended by remote control outside bomb. Right: Gamma radiograph of an aircraft component. Faults not seen by visual inspection include two blowholes clearly visible in the photo

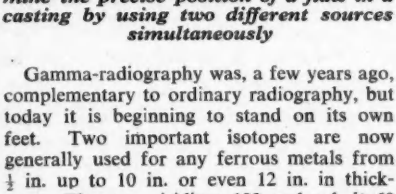
[courtesy, Panta Instruments

[courtesy, M. Falk Co.

Gamma-ray equipment set up to determine the precise position of a flaw in a casting by using two different sources simultaneously

Gamma-radiography was, a few years ago, complementary to ordinary radiography, but today it is beginning to stand on its own feet. Two important isotopes are now generally used for any ferrous metals from ½ in. up to 10 in. or even 12 in. in thickness. These are iridium 192 and cobalt 60 and cost only £20 to £40 in a useful strength. A third isotope, thulium 170, is already being produced on an experimental scale and is eminently suitable for the examination of thinner sections and light alloys. The half-life of iridium is about 70 days and of cobalt is 5.3 years, but long-lived isotopes such as caesium 137 are within reach of industrial production, and its half-life is about 33 years.

There are a few disadvantages of γ-radiography compared with X-radiography, such as longer exposure times and less sharp definition of the radiograph. The exposure times, however, have very seldom been found a disadvantage. What is more, the γ-ray equipment does not require any servicing or maintenance—an overnight exposure with the time switch is frequently possible and very welcome.



[courtesy, E.R.D. Ltd.

A typical gamma-ray bomb, weighing 33 lb.

Another great advantage is its reasonable price—from £48 to about £500, compared with £1,000-£3,500 for X-ray apparatus. X-ray equipment is very heavy, needs continuous attention, skilled operatives and its maintenance is costly, not to mention the cost of transport to the site and in use.

It is relatively simple to make a γ-radiograph. An X-ray film is placed behind the part to be radiographed, the gamma source is exposed at a certain distance for a specified time, after which the film can be developed and the radiograph is ready. Several pieces can be radiographed simultaneously with the same source, as of course radiation is emitted in all directions.

The size of an isotope used in this work is usually less than a ¼ in. in diameter and can be carried anywhere, inside a boiler tube, high up on a bridge or in any intricate part of a chemical plant.

Gamma-rays are not harmless but a number of British firms have produced equipment of remarkable safety and versatility. Only a few manufacturers are making it and for the time being there is little competition in this vast new field. This is partly due to the complicated nature of the pioneer work necessary in design, testing and marketing equipment of this type. Eventually, however, γ-radiography will be a routine method of testing for the majority of chemical and oil refining plants.

By far the most important development in the field in Britain has been made by Johnson Matthey & Co., the metal refiners, who have introduced clock-controlled equipment suitable for the irradiation of several objects simultaneously. Panta, the instrument makers, have also developed apparatus for precision remote-controlled radiography in inaccessible places up to 80 ft. away from the operator and for underwater radiography. Other makers, such as Gamma Rays, Ltd., and Solus Schall, Ltd., have built equipment for other special applications.

Sulphuric Acid in an Enclosed System

Use of Sulphur Derived from Crude Petroleum

IN a paper read to the Institution of Chemical Engineers at Burlington House on 9 December, the use of sulphuric acid in a totally enclosed reaction system was described by J. L. Edgar, Ph.D., B.Sc., A.R.C.S., D.I.C., F.R.I.C., of the Shell Refining and Marketing Co., Ltd. The following is an extract from the paper:—

Vast quantities of sulphuric acid are used in industry. Whether or not this acid can be recovered depends on several factors; of these two of the most important are the purpose for which the acid is used, and the strength of the spent acid obtained as an end product.

Obviously, if the acid is used in a process wherein it is converted into inorganic sulphates, that part so converted cannot be recovered by a simple reconcentration process. The remainder which has not reacted can be reconcentrated and the salts which are consequently precipitated can be filtered out, but it is not proposed to consider such processes here. It is intended to discuss only that type of process which uses sulphuric acid as an intermediate or an absorption medium, and in which, apart from a small operating loss, the acid is not consumed or converted to other products. However, in a process where sulphur is lost during the cycle, additional sulphur has to be introduced if it is intended to operate as a totally enclosed system, i.e., one which is independent of outside sources. How this can be done in a modern petroleum refinery is discussed in this paper.

Strength of Acid

Whether or not sulphuric acid can be recovered economically from spent acid obtained from a process in the course of which the acid does not undergo any substantial chemical change, depends to a large extent on the strength at which the spent acid is obtained, and on the quantity of acid employed—evidently, if a process using 95 per cent acid results in the production of a spent acid with a concentration of say 5 per cent, the quantity of water which has to be evaporated in order to reconcentrate the acid makes recovery uneconomic.

The thermal considerations in the concentration of sulphuric acid were discussed by Zeisberg in a paper published in 1922.[1] In order to concentrate sulphuric acid, after the solution has been raised to its boiling point, further heat must be supplied to evaporate water, to decompose hydrates of sulphuric acid, and to raise the resulting more highly concentrated solution to its new higher boiling point. Thus the heat to be supplied after the boiling point has been reached can be considered as being made up of three components—the heat of vaporisation, the heat of dehydration, and the heat of 'maintained' boiling.

Other Factors Involved

However, when the economics of the disposal or recovery of waste sulphuric acid are considered, other factors in addition to the actual costs of concentration have to be assessed. The erection of an acid concentration unit usually involves a large capital expenditure, which has to be amortised and on which interest has to be charged, but if the acid is not concentrated, an alkali must be used to neutralise the waste product before it is sent to the plant effluent system.

The cost of such a unit does, of course, depend to a large extent on the quantity of acid which has to be handled. It is a fairly simple matter to calculate the minimum concentration at which spent acid has to be obtained before it becomes economically attractive to recover it. Each case must be considered on its own merits, but generally speaking if the concentration of the spent acid is above 20 per cent Wt., it is an economic proposition to install recovery facilities. Below this concentration the amount of water that has to be evaporated is so great that it is no longer feasible to re-concentrate the acid.

However, it must be borne in mind that the actual costs for the heat used in concentrating acid represent only a small proportion of the total costs for operating an acid concentration unit. This is illustrated by the following figures, which show the breakdown of the cost of operating a vacuum concentrator which is concentrating about

150 tons per day of sulphuric acid (100 per cent) from 45 per cent Wt. to 85 per cent Wt.

Operating labour and materials	8.6
Maintenance labour and materials	37.7
Steam	18.8
Other utilities	7.6
Other fixed charges	27.3
	100.0

The actual cost of the steam which is used for heating (including a small quantity used in the vacuum ejectors) amounts to 10 per cent of the total cost, so that reduction in the concentration of the spent acid only increases the operating costs marginally, although the capital costs for the equipment are increased somewhat for lower concentration acid. It is clear that low concentration acids can be processed profitably, although there is obviously a limit which must be determined for each individual case.

Hundreds of Tons a Day

Quite apart from the profitability of the process, in many cases it is a practical necessity to reconcentrate the acid because of the very large quantities used. Many systems use an acid circulation rate of hundreds of tons per day, and it is quite impossible to discard these very large quantities of acid. It then becomes a matter of process design to ensure that the concentration of the spent acid is such that the costs of reconcentration are not too big a proportion of the total operating costs of a particular process. It is in such processes as these that acid reconcentration is of major importance.

The way in which the process of reconcentration fits in with the sulphur and sulphuric acid balance of a major complex of other plants will now be described. Sulphur which is present in a crude oil is obtained as a by-product from the cracking process in the form of hydrogen sulphide; this is converted to sulphur and thence to sulphuric acid, which is used throughout the refinery. The inclusion in the system of an acid concentrator and sludge decomposer allows the acid to be recycled and the sulphur balance throughout the refinery essentially to be maintained.

Crude oil may contain over 2 per cent of sulphur, and the cracking stocks which are prepared from this crude may contain over 3 per cent; about half of this latter sulphur is converted to hydrogen sulphide when these stocks are converted to motor spirit by catalytic cracking, at about 500°C.

The products from the catalytic cracker pass to a distillation unit in which they are separated into the various petroleum products, including a gaseous fraction containing the olefines from which synthetic chemicals are manufactured. All the hydrogen sulphide leaves the unit in this gaseous product, which is passed through a Girbotol Unit, where the hydrogen sulphide is absorbed in an aqueous solution of diethanolamine. The 'fat' solution of hydrogen sulphide in diethanolamine passes to a stripping column in which the H_2S is liberated by the application of heat; the stripped 'lean' solution, which is virtually free of dissolved H_2S, is then returned from the bottom of the stripping column to the top of the absorption column. Pure H_2S is obtained from the top of the stripper.

Sulphur is recovered from the hydrogen sulphide in a recovery unit, which consists essentially of a series of Claus kilns, heaters, coolers and product separators.

The hydrogen sulphide is burnt in a controlled stream of air, the heat thereby released being used for steam raising in a waste heat boiler. The following reactions take place:

$$H_2S + 1\tfrac{1}{2}\ O_2 = H_2O + SO_2$$
$$2H_2S + SO_2 = 2H_2O + 3S$$

Sulphuric Acid Balance

Under normal conditions the sulphur obtained from the recovery plant will be converted to sulphuric acid in a standard contact plant. This acid will then serve to supply the needs of the whole refinery. A major part of the acid will be used for purposes which produce waste sludges containing considerable acid, some of which can be recovered. Some acid is used for the manufacture of products containing sulphur, which therefore leaves the system as part of the molecule of these products, e.g., as sulphates in the alkyl sulphates which are marketed as detergents, or as naphtha sulphonates.

Generally speaking, acid is used for three major purposes. Part is used for the acid treatment of lubricating oils, transformer oils, medicinal oils, etc., and this results in the production of heavy acid sludges. The utilisation and disposal of acid sludges has recently been considered comprehensively in an Institute of Petroleum Symposium[5] held in October, 1951. At Stanlow a sludge decomposer is now being installed, in which

the sludge is decomposed thermally by direct contact with hot coke; this process is discussed in the above-mentioned symposium and has been fully described in a *Chemical and Metallurgical Engineering* flow sheet.[3]

The second major purpose for which sulphuric acid is used is in the manufacture of synthetic detergents. Here the sulphate ion leaves the process as part of the product and cannot, of course, be recovered.

The third purpose for which sulphuric acid is used is the manufacture of synthetic solvents. Here there is a very large acid turnover of several hundred tons per day. The acid leaves the system as a dilute solution which is reconcentrated and used again, so that the process embodies a totally enclosed acid system, and additional acid has to be introduced only to make up for losses by pump gland leakage, acid decomposition, carry-over, etc.

Thus in this refinery, by the combination of a sulphur recovery unit, an acid concentrator, and a sludge decomposer and contact plant, the sulphuric acid supply is entirely self-contained and is independent of outside sources. There is in fact a surplus of sulphur beyond the total requirements of the refinery, and the petroleum industry has been able to sell large quantities of sulphur to other users.

Improvement Hoped For

However, the plants can be operated with a totally enclosed sulphur and sulphuric acid system only under normal conditions; at the present time the sulphur position is abnormal. There is a grave shortage of high-purity sulphur, while sulphuric acid can of course be made from other materials. For this reason all the sulphur, which is better than 99.9 per cent pure, is sold, and sulphuric acid for refinery use is purchased from outside. It is hoped that eventually the situation will become normal, when the system can be utilised in the manner for which it was designed.

An attempt has been made to show how a large complex of processing plants such as a major petroleum refinery can be made independent of outside sources for its supplies of sulphuric acid. At the Stanlow Refinery this aim will shortly be achieved. At the same time, the major petroleum companies have no desire to enter the heavy chemicals industry, and it is believed that they would never contemplate the possibility of themselves becoming major suppliers of sulphuric acid to outside consumers. All hydrogen sulphide surplus to the internal sulphur balance will be converted to sulphur and sold as such. It is only a short time since all hydrogen sulphide produced in a refinery was burnt as a fuel in boilers and furnaces. Once again the petroleum industry has taken a waste product which was a considerable nuisance and has converted it into a most valuable by-product, which not only serves the industry itself but also plays an important part in the national economy.

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[2] 'Acid Sludge—Its Utilisation and Disposal,' *J. Inst. Pet.*, **38**, 1 (1952).
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Pharmaceutical Exhibition

TO commemorate the 1852 Pharmacy Act, the Pharmaceutical Society staged an exhibition at their headquarters, 17 Bloomsbury Square, London, W.1, on 3 and 4 December.

In 1850, the founder of the Society, Jacob Bell, presented a Bill which later became the Pharmacy Act of 1852 regulating the qualification of pharmaceutical chemists—the Society thus becoming a statutory body.

One section of the exhibition was devoted to apparatus and containers used about a 100 years ago including a compound microscope used in vegetable drug studies, gaily coloured leech jars and an interesting collection of china pot lids used for advertising bear's grease. Another part of the exhibition was given to drugs used in the 1850 period including a comprehensive display devoted to the work of John Elliott Howard on cinchona. Also on view in the library was the Royal Charter of the Society and a number of original manuscripts.

Additional Sterilisers

It is announced that Messrs. Baird & Tatlock (London), Ltd., scientific equipment manufacturers and laboratory furnishers of Chadwell Heath, Essex; Messrs. W. B. Nicolson (Scientific Instruments), Ltd., of Glasgow; and Messrs. W. & J. George & Becker, Ltd., laboratory furnishers and manufacturers of scientific apparatus of London and Birmingham, have been appointed additional distributors for laboratory glassware by Quickfit & Quartz, Ltd.

South African News Letter

FROM OUR OWN CORRESPONDENT

THE first production of asphalt from petroleum in South Africa is to take place at the oil refinery being erected by the Standard-Vacuum Refining Co. in Durban. In 1954 the refinery is expected to produce about 20 per cent of the total South African demand. The company reports that it is planning an addition to the refinery to provide for the manufacture of 25,000 tons of asphalt a year. These additional facilities are estimated to cost £600,000 and it is hoped to have the asphalt manufacturing in operation when the refinery begins production in 1954. It will produce paving grades and cut-back asphalt from petroleum sources in Durban. It has been necessary to import large quantities of asphalt for South African roads and because of this the Government is fully supporting the new industry.

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One of the recommendations of the Cement Inquiry Commission to relieve the scarcity of cement is that consideration be given to the manufacture of cement from blast-furnace slag. In its report it said that Iscor was producing about 1,000 tons of such slag a day at the Pretoria steelworks. At present the slag was being dumped as waste. Overseas experience had shown that costs per ton for the manufacture of cement from blast-furnace slag were invariably lower than those for Portland cement. The latest issue of *Research Review*, a quarterly publication by the Council of Scientific and Industrial Research, says the fact that Iscor slags can be used for the manufacture of hydraulic cements 'holds out the possibility of opening up a new source of cement in this country and thus removing one of the bottlenecks in European and non-European housing projects.'

Expansion of the productive capacity of the Union's cement industry is recommended by the commission. Scarcities of coal, limestone, tarpaulins and trucks caused a production loss last year. The commission agrees with the Coal Commission that an investigation should be made now into the country's future transportation needs. While the cement scarcity continued the present relaxation of the restrictions on the transportation of cement by road should remain. Cement prices should continue to be fixed on a 'f.o.r. destination' basis. Prices in smaller centres should be investigated to ensure that they got their fair share. The commission does not recommend Government control of the local distribution of cement.

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The Pretoria Portland Cement Co. continued to pass through a difficult period said the chairman in his annual address. Resources were being stretched to the full to complete the long-term expansion and modernisation programme at the company's various factories. Operations had been restricted by the generally inadequate transport position. Costs of production continued to rise and the selling price of cement remained fixed at an inequitably low level. The rate of taxation had increased still further. Profits and dividends had suffered accordingly. He referred to the Cement Commission's report which invited the Government to consider the need for immediate price adjustments for cement when any change in rail rate was applied.

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The South African paint industry now claims that the country is almost self-sufficient in these products. In addition local paint manufacturers have succeeded in building up a big export business to other parts of Africa and Eastern countries. It is expected to extend this business as since the establishment of the Paint Industries Research Institute some years ago, users can be guaranteed a first class product able to meet competition from other countries.

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At least 1,000 whales are caught annually off the South African coast, according to the Council for Scientific and Industrial Research. The large quantity of glue-water left behind when the blubber is cooked for the oil was once wasted. Now the National Chemical Laboratory has evolved a way to spray-dry this glue-water and the method has been applied on a commercial scale in Durban. Protein so recovered is used in cattle foods and the powder is expected to be of value as a processing agent in the extraction of minerals.

Coal Hydrogenation Chemicals

Carbide & Carbon Executive Reads Paper in New York

THE practical use of coal as a raw material for the production of chemicals has been an increasingly intriguing problem to chemists and engineers since 1856. At that time Sir William Perkin synthesised mauvine, the first synthetic dyestuff. But the first real indication that more coal could be converted into chemical products did not come until 1913 when Friedrich Bergius showed that coal could be liquefied with hydrogen at high pressures and moderate temperatures.

These facts were given by Mr. H. B. McClure, vice-president of Carbide and Carbon Chemicals Company, when he preesented a paper 'Coal Hydrogenation Chemicals' at the semi-annual meeting of the Manufacturing Chemists' Association in New York on 25 November.

Development of the Bergius process for the liquefaction of coal, Mr. McClure stated, was started on a commercial scale in 1927 in Germany when the first coal-hydrogenation plant was built by I. G. Farben to produce fuel liquids. In 1935 Imperial Chemical Industries built a single plant at Billingham and this ran for a short time on coal before being converted to creosote oil or oil tar feed stocks.

In the United States a coal-hydrogenation demonstration plant was built in Missouri in 1949 by the U.S. Bureau of Mines. This was designed primarily for the production of liquid fuels. In May of this year Carbide and Carbon Chemicals Company announced initial operation of a 300-ton-per-day coal-hydrogenation chemicals plant in West Virginia. This plant was the first and, to the best of Mr. McClure's knowledge, the only such plant constructed to-date for the production of chemicals rather than fuels. Also, it was the only coal-hydrogenation plant built entirely with private funds.

Major Achievements

Superficially, the process used in this plant was similar to the earlier process. Practically, so many details of engineering, operation, and processing techniques had been changed that the resemblance was hardly more than skin deep. The major achievements made in the design of this plant (said McClure) could be summarised as follows:

1. Coal processing time under high pressure with hydrogen was reduced to about 4.5 minutes, instead of perhaps 45.
2. Operating pressures were reduced to between 3,500 and 6,000 lb. per sq. in. from 7,500 to 10,000 lb. per sq. in.
3. Less hydrogen was required than was used in the German process.
4. The products were composed almost entirely of aromatic chemicals, not fuels.
5. Only one liquid phase hydrogenation step was included, eliminating the vapour phase operation entirely.

Hydrogen 'Knife'

It was believed, he said, that the actual structures of the final fragments existed more or less as units in various portions of the many 'macro molecules' that make up coal. By less rigorous operating conditions than those used in the coke oven, they were able to cut these large fragments loose as molecules with a sort of hydrogen knife. This was borne out by the fact that most of the chemicals obtained were complex benzene compounds or cyclic structures with many hydrocarbon 'whiskers.' Much smaller quantities of gases and simple benzene compounds were also formed. Furthermore, many of the portions of the structure containing nitrogen or oxygen remained intact.

As the result of this gentler hydrogenation treatment, they obtained directly from coal many chemicals normally synthesised from the simpler products of the coke oven operations. These included aniline, phenol (in much larger quantities per ton of coal than 'natural' phenol from coal tar), toluidine, xylidine, quinoline, and rather large quantities of indole. Carbazole and beta-naphthol are also obtained. It was recognised, of course, that the coke oven did produce significant quantities of indole, carbazole and quinoline. However indole or its derivative, carbazole and quinoline derivatives were also synthesised from simpler molecules to augment the coal tar supply.

Not to be forgotten were propane and ethane, on which Carbide and Carbon Chemicals Company had built its business. They were of course interested in these gases

as raw materials for the more than 300 chemical products they made from them. It would not be necessary to build a very large commercial coal-hydrogenation plant to produce enough ethane and propane to operate one of their large aliphatic chemical plants. In this respect, the original purpose of Carbide's research workers had not been completely lost in the shuffle.

The coal tar and light oil industries had been expanding at the rate of two to three per cent per year, pretty much paralleling the steel industry. Despite the more efficient recovery processes that had been and were being installed, there was no long-term prospect of rapidly increasing supplies from this source. They had already seen that the petroleum industry had done service in augmenting the supplies of benzole and toluol, and might contribute to increased availability of naphthalene.

The demand side of the picture, on the other hand, was one of rapid expansion. The expanding uses for benzole were well-known, particularly in polystyrene resins and styrene for synthetic rubber. Still another facet of the rapidly growing benzole market, or its equivalent in phenol, was the synthetic detergents' use, which had been increasing during the last few years at the rate of 30 per cent per year. This use also consumed smaller amounts of naphthalene. In resins, the rate of growth had been 35 per cent per year for polystyrenes, and 14 per cent per year for phenolic resins. The expanding market for alkyd resins and plasticisers for coatings represented by demand for phthalic anhydride had been growing at the rate of 15 per cent per year.

Huge Markets Seen

On top of these growing markets, his firm's crystal ball divined huge markets for new end uses. Some examples of these that were already on the near horizon were blowing agents for plastics. Structural materials that required aromatic chemicals were coming. Turning from shelter and transportation to clothing, one could find aromatic chemicals of great importance in the new textile fibres, such as nylon and 'Acron' ('Terylene').

As supplies of chemicals increased, energetic sales policies and application research usually developed the markets faster than plants could be built to supply the demand. The history of the Carbide and Carbon Chemicals Company was a case in point. In 1926 they shipped their first tank car of ethylene glycol, not for antifreeze, but to manufacture low-freezing dynamite. Since 1919 from very small beginnings, the synthetic aliphatic industry had grown in the space of 33 years until it now produced over 8,000,000 short tons of products.

British Tar Confederation

President & Officers Elected

OFFICERS for the year 1952/53 were elected at the annual general meeting of the British Tar Confederation held on 27 November.

Principal posts were:—*President*: SIR WALTER BENTON JONES, Bart.; *hon. treasurer*: C. E. CAREY; *chairman of the executive board*: W. K. HUTCHISON; *vice-chairmen of the executive board*: MAJOR A. G. SAUNDERS and R. H. E. THOMAS.

The following constitute the executive board for the year 1952/53, apart from the 10 representatives from the Gas Council:—

Association of Tar Distillers:—

L. W. Blundell (North Thames Gas Board); C. E. Carey (South Eastern Gas Board); E. Hardman (E. Hardman, Son & Co., Ltd.); Capt. W. Harriss (Prince Regent Tar Co., Ltd.); C. Lord (Lancashire Tar Distillers, Ltd.); Wm. McFarlane (Scottish Tar Distillers, Ltd.); S. Robinson (Midland Tar Distillers, Ltd.); Major A. G. Saunders (Burt, Boulton & Haywood, Ltd.); L. Shuttleworth (Dorman, Long & Co., Ltd.); W. A. Walmsley (Thomas Ness, Ltd.).

British Association of Coke Oven Tar Producers:—

Lt.-Col. P. F. Benton-Jones (United Coke & Chemicals Co., Ltd.); A. Bradbury (Stavely Iron & Chemical Co., Ltd.); G. W. J. Bradley (National Coal Board (East Midlands Division)); W. Robson Brown, M.P. (Richard Thomas & Baldwins, Ltd.); K. McK. Cameron (Stanton Ironworks Co., Ltd.); F. W. O. Doddrell (National Coal Board (North Eastern Division)); C. F. Dutton (National Coal Board); C. M. Frith (South Yorkshire Chemical Works, Ltd.); C. F. Sullivan (National Coal Board (South Western Division)); R. H. E. Thomas (National Coal Board).

Low Temperature Coal Distillers' Association of Great Britain, Ltd:—

Commander Colin Buist, R.N. (retd.).

Intensive Research Results

Mr. F. G. C. Fison Emphasises Need for Long-Term Policy

THE need to carry out its own research work as well as to take advantage of the work done in Government-aided research establishments, was emphasised by Mr. F. G. C. Fison, chairman, in his review of the year ended 30 June, 1952, at the 59th annual general meeting of Fisons, Ltd., held at Felixstowe on 5 December.

It was the intention of the company, said Mr. Fison, to expand its facilities for research on the fertiliser side to include both short-range and long-range objectives, and to equip itself with additional laboratories, pilot plant facilities, and experimental field plots sufficient to give a conclusive trial to any of the company's products.

World shortage of sulphur had stimulated interest in all forms of phosphatic fertilisers which offered prospects of economy in the use of sulphuric acid. Among possible alternatives to superphosphate the nitrophosphates were of considerable importance, and the research laboratories had continued the study of their properties and methods of production.

In collaboration with Rothamsted Experimental Station Fisons was taking part in a comprehensive series of field trials to ascertain their agronomic value in different parts of the country.

Research continued on the recovery of sulphur from the gypsum filter cake produced at Immingham as a by-product of triple superphosphate manufacture. This important possibility was still some way from an economic solution.

Synthetic Blood Plasma

On the pharmaceutical side research had been sustained in the field of 'blood plasma substitutes' and had been rewarded by marked success. In the solution of the many fundamental and technical problems associated with dextran Benger's research laboratories had been pre-eminent.

In fine chemicals the research laboratories continued to do basic work on a number of new products, and in particular had given much attention to hydrazine and its derivatives. It was becoming realised that derivatives of hydrazine were likely to have important industrial applications in the future, and the company was taking steps to secure full advantage from the pioneering work which it had done in this field. Close liaison was being maintained with corresponding research work now in hand in the U.S.A.

Usage of fertilisers in Great Britain is still much below the optimum in spite of the steady increase which has marked the last 20 years, more particularly the war and post-war periods.

Demand Not Increased

Reintroduction of a substantial subsidy on phosphatic fertilisers by the new Government did not increase the demand to the extent which, no doubt, the Government anticipated. The fertiliser industry itself was by no means wholly in favour of the reintroduction of the subsidy, particularly if it meant the same type of Government control as under former subsidy arrangements.

Anything which assisted in increasing the consumption of fertiliser was to be welcomed both from the national standpoint and the view of the industry, but it was open to doubt whether the application of subsidies was, in the long run, the best method of achieving this.

Both the farming community and industry would probably agree that while some direction and control by the Government was inevitable in the present national circumstances, this direction should be as broad as possible and leave the maximum initiative to the individual farmer and manufacturer. Changes of detail affecting this or that commodity made it difficult to plan for the future with any security.

Such long-term planning was particularly necessary in the case of the fertiliser industry, in view of the large size of the installations and the consequent inevitable delay between the decision to provide further manufacturing capacity and the availability of new production to the farming community. The industry would, therefore, welcome some announcement by the Government in regard to its longer-term plans, so that the necessary supplies of fertilisers may be available to meet increased demand.

Negotiations with the Government had

resulted in the reversion to private purchase of phosphate rock and potash.

In the case of the former commodity, the rather unusual step was taken by the industry of forming a private buying agency to act on behalf of the whole of the fertiliser industry of this country. The reasons leading to the formation of the company were chiefly that in the absence of some close collaboration between purchasers, much larger stocks of rock would probably have been required, and it was doubtful whether the industry was in a position to store the necessary quantities.

Position Being Watched

In view of the dependence of the Immingham plant on sulphur, the world supply position was being watched with the closest attention. It had become increasingly clear that while there was unlikely to be any absolute shortage of sulphur, elemental sulphur would not at any time in the foreseeable future revert to its former position as the cheapest available material for acid manufacture.

The Government had rightly refused to allow the conversion of further plants to pyrites, in view of the undesirability of the country as a whole becoming too dependent on this material, and a proportion of the acid requirements of the country would therefore continue for some considerable time to depend on the supply of elemental sulphur.

It was clear, however, that in the future anhydrite would assume an increasing importance as a raw material for the manufacture of sulphuric acid, and Fisons had already taken a considerable interest in the United Sulphuric Acid Corporation, which would produce 150,000 tons of acid from this indigenous material. The cost of acid, however, produced from this material was relatively high by pre-war standards, and the fertiliser industry is therefore turning its attention increasingly to materials other than sulphuric acid for the treatment of phosphate rock.

There was increasing interest in the use of nitric acid for this purpose, and this tendency was noticeable even in the U.S.A., where materials for sulphuric acid manufacture were more abundant and cheaper than in this country.

With the exception of the Immingham plant, the acid supply now available appeared adequate for requirements, and, in particular, the Government had restored the whole of the acid obtained under contract at the Avonmouth plant. While there appeared to be some grounds for thinking that the superphosphate industry might receive somewhat more favourable treatment than in the previous year, undue optimism in regard to the acid supply for the remainder of the current year would be premature.

Completion of the fourth bore in North-East Yorkshire within the next month would conclude the drilling programme. Results from the latter bores had confirmed early expectations of extensive deposits of potassium salts and, in conjunction with Imperial Chemical Industries, Ltd., a report describing the findings had been submitted to the Ministry of Materials.

The winning of potash from 4,000 ft. below the surface presents some unique problems, calling for expert advice, and Powell Duffryn Technical Services, Ltd., had been commissioned to prepare a report on the mining of the Yorkshire potash. This report had been received and was now being considered.

A proposal was submitted to change the name of British Chemicals and Biologicals, Ltd., to Fisons Chemicals, Ltd. The present name was rather cumbersome, and in addition it was thought that a direct association with Fisons would be of benefit, especially in the export markets.

Profits Less

Decline in profits shown by the accounts arose entirely on that side of the group's business dealing with pharmaceutical fine chemicals.

In other branches of the group the year was one of continued progress, in spite of the more difficult conditions obtaining in the latter half, the sales of proprietary products, ethical medical specialities, and milk products reached new high levels. Although profits were to some extent affected by steep rises in raw material prices in the first half of the year, the businesses concerned all showed improved results. Export sales of fine chemicals and medical specialities also showed satisfactory increases.

Turnover of the industrial fine chemical department increased at a rapid rate in spite of the general recession in chemicals.

Catalysis by $Cu(OH)_2$

Inhibition by Magnesium Hydroxide

IT is well known that small amounts of copper compounds markedly stimulate or accelerate certain reactions. For example, hydrogen peroxide in alkaline solution is decomposed by cupric hydroxide, and the effect seems to increase linearly with the square of catalyst concentration. Magnesium hydroxide can be used for removing traces of heavy metals, especially copper from alkaline solutions, and for inhibiting their catalytic action. J. D'Ans and J. Mattner have recently described their work in this direction with hydrogen peroxide and peracetic acid solutions, in the Raschig hydrazine synthesis, and in the manufacture of pure water. (*Agnew. Chem.*, **64**, 448-452).

Removal of Copper

Experiments have shown that small precipitations of magnesium hydroxide from alkaline solutions can remove even the smallest traces of copper by combination with it. There is no longer any catalytic decomposition of hydrogen peroxide and other substances in these solutions. Such 'catalytic' detection of copper is extremely sensitive. If ammonia is present combining of copper is no longer quantitative. The ammoniacal solutions must be prepared from specially pure water (*see* below) and ammonia gas, as used, for example, in the Raschig synthesis of hydrazine. The ultra-pure water is obtained by purifying with magnesium hydroxide precipitation. Traces of heavy metal such as copper are thus much more effectively removed than by repeated distillation.

The authors discuss results in the stabilisation of hydrogen peroxide solutions, including the work of A. Glasner on their catalytic decomposition (*J. Chem. Soc.*, 904 (1951)), and similar work with peracetic acid. In the Raschig synthesis of hydrazine they tried the use of magnesium hydroxide instead of glue or gelatin as a precipitant for traces of heavy metal, including copper. Other reagents are also recorded in the literature. The first experiments showed, however, that magnesium hydroxide was less effective than glue, due to its inability to combine with all the copper present in the ammoniacal solutions. If these were prepared from ammonia and very pure distilled water, as noted above, the effect of the hydroxide was much improved. The hypochlorite solution was freed from precipitate by treatment with magnesium hydroxide and decanting. The various experiments are described in detail.

Industrial Illumination

What Design Should Aim At

LIGHTING plays a vitally important part in the chemical and allied trades, but it also presents unusual problems, as safety requirements may necessitate vapour-proof, dust-proof, or flame-proof fittings, while at the same time handling of minute quantities of a substance, accurate measurement, comparison of colours and so on, make the best possible vision essential.

The main function of factory lighting must be to provide conditions which stimulate endeavour, reduce fatigue, and ensure effective results from the work done.

What is the difference between good and bad lighting? To what extent does good lighting affect individual output? On what data should lighting systems be planned? Answers to these questions and many others are given in 'Lighting in Industry,' the second volume in the series 'Electricity and Productivity,' produced by the British Electrical Development Association.

The book consists of 154 pages with 85 illustrations. There are seven chapters, as follows:—Lighting and Productivity; Lighting and Factory Management; Some Particular Factory Lighting Applications; Lighting in Various Industries: The Use and Maintenance of Factory Lighting; Colour in Factories; and Lighting Design.

Chemical works do not receive particular attention except for a reference under the heading 'Lighting for Dangerous and Difficult Locations,' in the chapter on particular applications, but, nevertheless, many sections are of interest to chemists. The problems of high bay workshop lighting, for example, lighting of storage areas, lighting for inspection, switching organisation, and a safety colour code, all deserve the consideration of chemical works managers and executives.

Copies of the volume (9s. post paid) may be obtained from the British Electrical Development Association, 2 Savoy Hill, London, W.C.2.

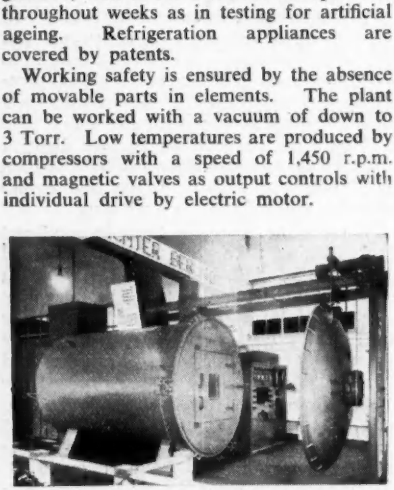
Material Testing

New East German Plant on Exhibition

THE latest model East German material testing plant with a working space of 1.8 cubic metres was shown for the first time at the Leipzig Fair in September. It tests the resistance of organic and inorganic materials and has a working range from 100-120°C.

A fully automatic process is controlled by a timing clock, and automatic controls can be pre-set for any desired working programme, such as for a continuous operation throughout weeks as in testing for artificial ageing. Refrigeration appliances are covered by patents.

Working safety is ensured by the absence of movable parts in elements. The plant can be worked with a vacuum of down to 3 Torr. Low temperatures are produced by compressors with a speed of 1,450 r.p.m. and magnetic valves as output controls with individual drive by electric motor.



For vacuum testing the end shield of the plant can be closed in one minute by a hydraulic pump (closing pressure 275 atmospheres) which is turned off when the vacuum has been created. Tests at different or changing temperatures are possible for engines as well as materials and stratospheric instruments. Any desired number of connections can be made for power current, including high frequency for measuring instruments. One control board serves the entire plant.

Maker of the plant is the Berlin firm, Joh. Alfred Richter. Series production began last year and so far 500 plants have been sent to Eastern Europe and the Soviet Union. Control markings on the plant shown are half in German and half in Russian, delivery having been made to the Soviet Union after the Leipzig Fair. Capacities at present being made in series range from 0.25 to 2.0 cubic metres. Larger plants are made to specifications. As in U.S. plants, the refrigerating agent is freon. Present East German production of the plants is entirely for export.

New Mixer for Laboratory Work

BELIEVING that much valuable data can be obtained from the customers' reaction to a new model, the Morton Machine Company, Limited, Wishaw, Scotland, has asked users of its new No. 'O' Duplex mixer to report on this machine.

This Duplex mixer has been designed primarily for laboratory work and for use in factories producing chemicals, plastics, pigments, foodstuffs, and other substances.

Reports show that the greatest advantages resulting from the use of this machine are the substantial savings in time and materials. Tests can be carried out in the laboratory achieving the same conditions of mixing as those employed in actual factory production, without using a full-scale production machine with the relative increase in quantity of materials and without the disadvantage of withholding such a machine from the production line.

Another point is the ease with which the machine can be stripped for cleaning.

The mixing container is constructed of stainless steel and has stainless steel 'Z' type beaters running in self-lubricating bearings which ensure that no contamination can affect the mix due to oil or grease leaking through the bearings. The body of the container can be fitted with a steam jacket or a vacuum lid.

A perspex lid is fitted to enable the operator to keep the mix under visual observation and also serves to prevent any access to the beaters while they are in motion. The machine is operated by opening or closing this lid.

Drive is by means of a chain from the motor to a two-speed gear-box and thence by precision machine cut gears to the beaters. Total capacity is seven pints with five pints working capacity. It has a half horse power motor giving 940 r.p.m. Beater speeds—front: 63 and 126 r.p.m., back: 100 and 200 r.p.m.

Indian Newsletter

(From Our Own Correspondent)

THE possibilities of utilising wood and bagasse for the production of power alcohol in India were discussed at a recent conference in Lucknow which was organised by the United Nations Economic Commission for Asia and the Far East and presided over by Mr. P. Burke Jacob (U.S.A.) Manufacture of power alcohol by wood hydrolysis was considered likely to prove too expensive, unless the by-products, such as dextrose, could be profitably recovered. Utilisation of bagasse, provided India was assured of regular supplies, was thought to be a feasible proposition, and it was suggested that a pilot plant should be tried out.

* * *

Petrol from coal has been produced on a pilot plant scale by the Central Fuel Research Institute in India. Output was one gallon a day and was obtained by the direct hydrogenation of Assam coal. The resultant oil has proved to be corrosive, and the research is now being directed towards other types of coal. Experiments are also being made to produce aviation spirit. In view of India's good coal resources and the lack of liquid fuels, these investigations are considered promising.

* * *

The titanium dioxide factory of the Travancore Titanium Products, Ltd., which went into operation early this year has now closed down for an indefinite period. The factory employed nearly 400 workers. It has been stated that the high cost of production and competition from cheaper imported pigments, were the reasons for the closure. It is likely that the Government of India may institute an inquiry into the position of the manufacture of titanium pigments in India.

* * *

Amalgamation of the Indian Iron and Steel Company and the Steel Corporation of Bengal has been approved by the boards of directors of the two firms. It was felt that the two companies might benefit mutually by a merger and would be better equipped to carry out development programmes as one economic unit. This was also recommended by the Indian Tariff Board. The merged companies are now to present a single front to the Government of India and the International Bank for Reconstruction and Development, for financial aid to increase quickly Indian production of iron and steel.

* * *

Provision of better trained personnel for the expanding mineral industry in India was discussed recently at a special meeting of the Mining, Geological and Metallurgical Institute of India. It was recommended that the present university courses in geology and the metallurgical sciences should be modified to include intense field training for the students and that the study of geology should begin at the intermediate standard. An exchange of personnel between the universities and the Geological Survey of India and close liaison between the universities and the mineral industry were advocated. A Mineral Research Institute to devote itself to problems of the mineral industry was also deemed essential. The meeting proposed the raising of a small levy on the mineral industry to help finance the institute.

Instruments Exhibition in Leeds

EXAMPLES of modern industrial measuring and controlling instruments were on view this week (Wednesday to Saturday, 10-13 December) in the laboratories of the Department of Coal Gas and Fuel Industries in the University of Leeds.

The exhibition, organised by George Kent, Ltd., was held in connection with the Departmental Courses in Process Instrumentation, and was open to the public by permission of the University authorities.

Apparatus exhibited included:—

A working demonstration of pneumatic process control on a 'Mark 20' flow ratio control unit.

Sectional models of the 'Mark 20' pneumatic controller, a KM recording manometer, RS/C steam shunt meter, and the M2 mechanical liquid meter.

Working demonstrations of flow measurement by a ring balance meter, a recording rotameter and a mechanical rotary meter.

Demonstration of combined temperature and CO_2 analysis of flue gases, and oxygen analysis of coal gas.

An exhibition of scientific instruments for industry and education was also held by Griffin & Tatlock, Ltd., of Manchester, at the Hotel Metropole, King Street, Leeds, from Tuesday to Thursday, 9-11 December.

HOME

RIC Title Changed

At the annual general meeting of the London and South Eastern Counties Section of the Royal Institute of Chemistry held on 19 November, 1952, it was resolved that the Section be known in future as the London Section. The following were elected officers for the ensuing year:—chairman, Dr. Norman Booth, B.Sc., F.R.I.C.; vice-chairman, Mr L. M. Miall, B.A., F.R.I.C.; Dr. K. G. A. Pankhurst, B.Sc., F.R.I.C.; hon. treasurer, Mr. W. H. Bennett, M.Sc., F.R.I.C.; hon. secretary, Mr. F. C. Hymas, M.Sc. F.R.I.C. hon. assistant secretary, Mr. A. J. Turnbull, A.R.I.C.

Distributors Appointed

Chemical Spraying Contractors, Ltd., of Glasgow Road, Perth, have been appointed main distributors in their area for Shell Chemicals, Ltd. The Perth firm will act as stockholders for Shell Agricultural Chemicals and will also operate a technical advisory service covering this field.

Precious Metal Assaying

The third meeting this session of the Midlands Society for Analytical Chemistry is to be held at 7 p.m. on Tuesday, 16 December, in the Mason Theatre of the University, Edmund Street, Birmingham. The subject for discussion is 'Precious Metal Assaying—Classical and Modern,' which will be opened by J. A. Hulcoop, chief assay chemist of Baker Platinum, Ltd.

Encouraging Production

The Minister of Materials was asked in the House of Commons recently what action he was taking to ensure an increase in the production of sulphur and sulphuric acid. Sir Arthur Salter replied that encouragement had been given to the erection of plant to produce sulphuric acid from pyrites and native anhydrite instead of sulphur. By the end of 1952, new capacity of this kind to produce 227,000 tons of acid would be working, and another 460,000 tons in 1953. A plant for recovering an additional 17,000 tons of by-product sulphur a year would be working in 1952, and another 12,000 tons in 1953.

Steel Production Record

Britain's steel production in November was at an annual rate of 17,951,000 tons. This is the highest rate recorded in the history of the industry. The previous best month was in November, 1950, when an annual rate of 17,472,000 tons was reached. Production is now being steadily maintained at above the previous peak rates established in 1950. This advance follows the progressive fulfilment of the industry's Post-War Development Plan which was started in 1946 and is due for completion by mid-1953.

Film Available

'Three Installations,' a film accepted as an example of a technical and documentary film and shown at the 1952 Edinburgh Festival is now available for free loan in 16 mm. and 35 mm. sizes from Richard Sutcliffe, Ltd., Horbury, Wakefield, Yorks. The film, which is the third made by this company, portrays the use of Sutcliffe mechanical handling equipment, particularly the use of belt conveyors and their accessories in industries other than mining. Three typical installations shown are at an ironworks, a cement factory and a civil engineering project. The commentary gives details of design, manufacture and erection.

Petroleum Search in Lancashire

Prospecting licences under the petroleum regulations for two areas in Lancashire have been granted to Steel Brothers & Co., Ltd., of London, according to a recent announcement in the *London Gazette*. One area is for 68 sq. m. bounded by Whalley, Burnley, Accrington and Blackburn. The other is an area of 156 sq. m. bounded by Horwich, Bury and Whitfield, Dunham, Massey and Winnick.

Cortisone Synthesised

Development of a method of synthesising cortisone at its Greenford, Middlesex, laboratories, was announced by the chairman, Sir Harry Jephcott, at the 18th annual general meeting of Glaxo Laboratories, Ltd., held in London on 5 December. It was emphasised by Sir Harry that this did not necessarily mean that a commercial process would be found.

OVERSEAS

Promising Potash Discovery

An important discovery of relatively high-grade potash has been discovered in West Central Saskatchewan by Liberal Petroleums, Ltd. The deposit is some 25 ft. thick and at a depth of 3,800 ft. but the extent will not be known until further drilling is carried out. Potash permits covering 100,000 acres in the Palo area, about 70 miles due west of Saskatoon, have been acquired by the Company from the Saskatchewan Government and the Canadian Pacific Railway. The only other important deposit in North America is in New Mexico and at present Canada is a big importer of potash.

Polish Training Course

A training centre has been set up in Warsaw by the Polish Ministry of Chemical Industry, to train personnel for technical and managerial posts within the industry. One-year courses in industrial administration will be held for advanced students, and practical training will also be given. It is the first course of its kind in the Polish chemical industry.

Bolivian Tin Mining Nationalised

A decree has been signed nationalising the Patino, Hockschild and Aramyo mines, the three major firms which control Bolivia's tin industry. About one-fifth of the world's tin supply comes from Bolivia. A contract for a smelter of 50,000 tons annual capacity is reported to have been signed by the Bolivian Government with an overseas syndicate.

Wolfram in Argentina

A second wolfram mine is reported to have been discovered in the Province of Medoza, at La Escondida, in the Department of San Rafael, Argentina.

Easing Brazil's Rubber Shortage

A synthetic rubber plant, using sugar-cane alcohol as the principal raw material, is to be set up by a French concern at Campos in the State of Rio de Janeiro, Brazil. It is hoped by the manufacture of synthetic rubber on a commercial scale to ease the demand for raw rubber, of which the present annual production is estimated to be some 14,000 tons short of Brazilian requirements.

Indian Inquiry Planned

The Indian Minister of Commerce and Industry has announced in the Indian parliament that the Government is to appoint a committee to inquire into the present state of development of the pharmaceutical industry in the country, and to make recommendations for suitable measures for putting this industry on a sound basis.

Power Alcohol Plans

The Government of India are taking steps to foster the production of power alcohol in the country, and the Indian parliament has just passed a Bill for that purpose. Mr. T. T. Krishnamachari, the Minister of Commerce and Industry, recently said that experts had estimated India's ultimate capacity to be an output of 25,000,000 gallons of power alcohol on the basis of a production of 400,000 tons of molasses per annum. Present production was, however, only a quarter of this capacity. Attempts were already under way in Madras and Bombay to produce power alcohol.

American Engineers Meet

Some 1,500 engineers and executives of the chemical and allied industries attended the 45th annual meeting of the American Institute of Chemical Engineers in Cleveland, Ohio, from 7 to 10 December. One of the outstanding events of the meeting was the Awards Banquet on 9 December, when three major honours in chemical engineering achievement were presented. The main address of the evening was given by John L. Collyer, president of the B. F. Goodrich Company.

New Drug Controls Blood Pressure

A new drug belonging to the alkyl nitro-indole group has been found in America to counter the blood-pressure-raising component in essential hypertension when taken orally. This has been developed from serotonin, the blood-vessel-restricting substance found in clotted blood, by modifying its chemical structure. The new drug has only been tried out on animals, but the fact that it can be taken by mouth would be a great advantage for humans clinically.

PERSONAL

The DUKE OF EDINBURGH has accepted election to honorary membership of the Institution of Mining and Metallurgy. He has also accepted a Life Membership of The Institute of Fuel.

DR. CHARLES ALLEN THOMAS, president of Monsanto Chemical Company, of St. Louis, U.S.A., and chairmen of the board of directors of the American Chemical Society, has been chosen to receive the highest award in American industrial chemistry, the Perkin Medal of the American Section of the Society of Chemical Industry, for 1953.

Dr. Thomas is honoured for outstanding contributions to many phases of industrial chemical development including the atomic energy programme; several phases of the pioneer development and general utilisation of anti-knock, high compression fuels for internal combustion engines; important contributions to knowledge of the chemical reactions of hydrocarbons in the presence of catalysts, particularly aluminium chloride; synthesis of resins and other useful products from petroleum and its by-products; fire fighting devices and methods; as well as for his leadership in both the profession and industry of chemistry.

Fifty-one years ago MR. H. CECIL BOOTH, F.C.G.I., M.I.C.E., late chairman of British Vacuum Cleaner & Engineering Co., Ltd., invented the vacuum cleaner and on 3 December at the Goblin Works, Leatherhead, a presentation of a gift of plate, together with an illuminated address, was made to Mr. Booth, as a souvenir on his retirement from the active chairmanship of the company. The gift was subscribed by donations from members of all office and factory staffs. The presentation was made to Mr. Booth by his successor, MR. J. J. HAMBIDGE who recently became the new chairman.

SIR CHARLES DARWIN, F.R.S., has been appointed chairman of the Radioactive Substances Advisory Committee in succession to SIR HENRY DALE, O.M., F.R.S., who has resigned. PROFESSOR G. R. CAMERON, F.R.S., and PROFESSOR K. G. EMELEUS have been appointed to the committee it is announced by the Ministry of Health. The committee, which is composed of scientific and medical experts, was established in 1949 to give advice on protective measures against radioactivity.

The following changes have been made in the Boards of the Dyestuffs and Nobel Divisions of Imperial Chemical Industries, Limited:

MR. C. PAINE has been appointed chairman of Dyestuffs Division in place of MR. P. K. STANDRING, now a member of the I.C.I. main board. DR. J. AVERY has been appointed a division managing director (jointly with MR. H. JACKSON), MR. H. SMITH a division director, and MR. J. C. H. MCENTEE a division director (visiting).

DR. J. CRAIK has been appointed a Nobel Division managing director (jointly with MR. J. ROBINSON and DR. A. G. WHITE), DR. J. TAYLOR having relinquished that office on his appointment to the I.C.I. main board. MR. J. M. HOLM has been appointed a division Director.

Consultants Co-operate

Bulstrode Technical Services, Ltd. and Dr. M. A. Phillips and Associates, both of which are consulting chemists and chemical engineers, announce that they are now working together on a co-operative basis. Dr. W. Francis, M.Sc., F.R.I.C., F.Inst.F., director of the Bulstrode Technical Services, Ltd., has joined Dr. M. A. Phillips and Associates. He is a consulting fuel technologist and industrial chemist with many interests, including the development of chemurgic processes and the author of a number of books on technical subjects.

Limestone Waste for Fertilisers

A proposal to utilise the limestone waste from the National Steel Plant at Huachipato for the manufacture of fertilisers is being studied by the Sociedad Agricola del Sur, Chile. It is expected that an annual production of some 20,000 tons could be attained.

The Chemist's Bookshelf

THE OXIDATION STATES OF THE ELEMENTS AND THEIR POTENTIALS IN AQUEOUS SOLUTIONS. 2nd edition. By W. M. Latimer. Prentice Hall Inc., New York; Constable & Co., Ltd., London. 1952. Pp. xvi + 392. 42s.

In the preface to the first edition of this book the author pointed out that the energies of the elements in their different oxidation states, which the book provided, could be used by one with only a slight knowledge of thermodynamics to answer qualitatively many questions arising in inorganic chemistry. The thermodynamic data have been revised and extended in this second edition and free energies, heats and entropies of formation are given for the important compounds of each element.

The book is, however, much more than a collection of data. It starts with clear definitions of the units and conventions used and discusses the general methods employed in the determination of oxidation-reduction potentials, including the use of cells, free energies and equilibrium constants, and thermal data. The term oxidation-reduction potential is used in the wider sense as meaning the electrode potential of the element in a particular state of oxidation. The use of potential diagrams in the interpretation of the chemistry of an element is discussed. Factors, such as ionisation potential, electron affinity and lattice energy, which affect the standard electrode potential are considered. Understanding is helped by well chosen examples.

The oxidation states of the elements are then given in detail, a chapter being generally devoted to a group of related elements. Potentials are summarised at the end of each chapter. The elements considered include the lanthanides and actinides, the chemistry of the latter group having been considerably extended. Data on astatine, technetium (masurium) and francium are included. Under carbon is given data for aniline-nitrobenzene, hydroquinone-quinone and the potentials of some oxidation-reduction indicators and substances of biological interest. Treatment is generally full and up-to-date.

Throughout the book, thermodynamic values are summarised in tables. Appendices include a summary of oxidation-reduction potentials, a discussion on the activities of strong electrolytes which includes values of activity coefficients, and methods for the estimation of entropy values. A guide to the order of the arrangement of the elements in the text and some study problems are also given. The book provides a mass of well ordered data which should be of value in providing a logical basis for the interpretation of many inorganic reactions. It will be of interest to research workers and others interested in inorganic problems and may be read with profit by final honours degree students.—W.R.M.

AN INTERNATIONAL BIBLIOGRAPHY ON ATOMIC ENERGY. Vol. 2. SCIENTIFIC ASPECTS. Supplement No. 1. Atomic Energy Section, Department of Security Council Affairs, United Nations, New York. Sales No., 1951, ix, 1. HMSO, P.O. Box 569, London, S.E.1. 25s.

This is the first of a series of projected supplements to the main Bibliography which was reviewed some time ago in this Journal (THE CHEMICAL AGE, 1951, **65**, 100). As before, the pages are un-numbered. The faults in sub-division previously noted have to some extent been removed by further sub-division and rearrangement.

Over 8,000 references are included, listing papers published in 1949 and 1950. It is stated that for completeness those papers published in early 1949, and included in the original volume 2 have also been included in this supplement. The point of this is not quite clear, since it is obvious that anyone interested in the main volume will also be interested in the supplement, and *vice versa*.

Appendices include an author index and a fifteen-page list of journals used.—W.

PAPER CHROMATOGRAPHY: A LABORATORY MANUAL. By R. J. Block, R. LeStrange and G. Zweig. Academic Press, Inc., New York. Academic Books, Ltd., London. 1952. Pp. x + 195. Figs. 31. Plates II. $4.50.

A large bulk of literature has appeared in recent years dealing with the techniques and applications of paper chromatography. Upwards of 400 references are given in the bibliography of this book, and this makes no claim to be exhaustive. Of these references the majority are specialised. It seems expedient, therefore, that some review of the field should be available, which would both indicate the multiplicity of applications and give in convenient form detailed directions for the more important of the techniques which have been devised up to the present.

The apparatus required for paper partition chromatography is simple, and may be nothing more than sheets of filter paper together with such odds and ends of apparatus as may be found in any laboratory. To this fact, to some extent, must be attributed the wide popularity of the method.

But in addition, of course, paper partition chromatography has proved to be a powerful analytical weapon in certain fields, and its applications to other fields have been widely investigated. Indeed it may perhaps have suffered from a too ready belief among some workers that it is the sole answer to analytical problems. The present book does not do as much as it ought to dispel misconceptions of this kind. It is hardly sufficiently stressed, for example, that partition chromatography has been successfully carried out on media other than paper. And there is little reference to 'normal' chromatography on paper, which can equally prove an effective weapon in the right circumstances.

Following on a brief and reasonably simple review of such theory of the processes as exists at present, a detailed account is given of the more important methods and their experimental requirements, both qualitative and quantitative methods being discussed. The bulk of the remainder of the book is given up to the applications to specific organic problems. Amino acids, amines and proteins, carbohydrates, aliphatic acids and steroids, purines and pyrimidines, phenols, aromatic acids and porphyrins, antibiotics and vitamins are dealt with in turn. A further chapter is devoted to miscellaneous organic substances.

There is an all too brief chapter on inorganic separations which hardly does justice to the large amount of work done in this field, and which, by failing to make any clear distinction between 'normal' and 'partition' chromatography, provides possibly the only justification for the general title of the book, which should more properly be 'Paper Partition Chromatography.'

The book is a useful compilation of scattered information and should prove of considerable use to workers who are coming fresh to the field. In the publishers' 'blurb' it is stated that 'an abundant literature has appeared on the subject in the last eight years, but until now no concerted effort has been made to correlate the work.' The present book can hardly be said to do so, and on the whole only collates the information. The principal fault which can be found with it is the small amount of critical appraisal. Thus although the beginner should find the book useful he will have to use it with judgment and restraint.—C.L.W.

DIE ENTWICKLUNG NEUER INSEKTIZIDE AUF GRUNDLAGE ORGANISCHER FLUOR-UND PHOSPHOR VERBINDUNGEN. Second Edition. By Dr. Gerhard Schrader. Verlag Chemie, GmbH, Weinheim. 1952. Pp. 96. 12s. 6d.

This handbook, No. 62 of the publishers' series of Monographs on Applied Chemistry, is a revised and amplified edition of the 1951 publication (reviewed in CHEM. AGE, **64**, p. 251). It attempts to correlate all the recent information on the chemistry of organic fluorine and phosphorus compounds, which is an ever-growing development. It contains details from the principal literature, together with a great deal of hitherto unpublished data—viz., results of the author's research on the new insecticide 'Systox' and the production of a series of organic phosphorus-selenium compounds. The present edition also contains physical data of the more important compounds, such as steam pressure and volatility and exact analytical methods for the various products.

As one of the more notable trends in modern agriculture is the increasing use of insecticides, fungicides and chemical weed killers, this book will be of value to all those who read German as a comprehensive bibliography. There are hundreds of references in footnotes and an appendix list represents a unique compilation of literature.—F.N.

Publications & Announcements

SPEED of operation is one of the advantages of a new ring-cutting machine designed by Richard Klinger, Ltd., of Sidcup, Kent. It takes less than 20 seconds to cut a joint ring of 24 in. diameter by 1/16 in. thick on the new 'Klingerit' machine, to which a steel tape is attached, marked in both inches and centimetres, for setting to size. It is possible to cut rings up to an outside diameter of 48 in., down to a minimum inside diameter of 2 in. The machine is light (only 14 lb. weight), but robust and can be used without having to be permanently attached. Full details of the 'Klingerit' ring-cutting machine with operating instructions are given in leaflet J.21-22.

* * *

THE 1953 edition of the booklet, 'Physical Properties of Synthetic Organic Chemicals,' has just been issued by Carbide and Carbon Chemicals Company, a Division of Union Carbide and Carbon Corporation. This year for the first time the 20-page booklet includes a section on 56 new research chemicals available from Carbide and Carbon. Among them are synthetic *alpha*-picoline, diethoxy tetrahydrofuran, a source of succindialdehyde, and four new vinyl monomers. The new edition presents data on more than 320 products. For easy reference, the chemicals are arranged by family groups. Condensed data on applications are presented and physical properties are given in tabular form. Copies may be obtained without charge from Carbide and Carbon Chemicals Company, 30 East 42nd Street, New York 17, New York.

* * *

RECENTLY we received a sample of the new process of permanent printing on polythene containers developed by Industrial Appliances, Ltd. Printing on polythene has been an extremely difficult problem but, after several years of constant research and experiments, this has been overcome. The printing is raised, clear, and easily stands the Scotch tape test and is said to be impervious to most spirits and liquids. A separate company, Polyscript, Ltd., has been set up to undertake the printing on Industrial Appliances' 'Poly-Tainers' as well as other polythene products which may or may not be manufactured by the firm. The address is 21 Grosvenor Street, London.

UP UNTIL quite recently jute bags have been made with one or two seams at the side but now a new type of sack made from tubular cloth has been introduced and is gaining favour rapidly. Fairbairn Lawson Coombe Barbour, Ltd., of Leeds, have announced that they are now able to supply these seamless bags and that regular users of them include Imperial Chemical Industries, Ltd., and Spett Ditta Montecantina in Italy.

* * *

MORE than 900 firms in the Swiss chemical and allied trades are listed in the new (6th) edition of *Die Chemische Industrie der Schweiz und ihre Nebengebiete* (*l'Industrie Chimique en Suisse, et ses Produits Annexes*), published by Verlags für Wirtschaaftsliteratur GmbH. Zurich. The volume is divided into 17 sections (heavy and fine chemicals, pharmaceuticals, cosmetics, soaps, dyes and colours, mineral oils, animal and vegetable oils, explosives, gas technique, glass, ceramics, etc.) and also gives a list of chemical apparatus and plant and particulars of the Swiss chemical organisations and associations. There is an introduction by Professor H. Mohler, president of the Association of Swiss Chemists, stressing the importance of Switzerland's chemical industry in European co-operation and showing how the association has taken a leading part in helping to collaborate the work of applied chemistry in Europe. The volume supplies a work of reference which will be appreciated abroad as much as in its country of origin.

* * *

CHEMICAL methods of estimating the insecticidal activity of pyrethrum are discussed by C. Potter and K. A. Lord, of Rothamsted Experimental Station, Harpenden, Herts., in the July issue of *Pyrethrum Post* (Vol. 3, No. 1), official publication of the African Pyrethrum Research Council. Other articles include 'Applications of pyrethrum in Public Health and Related Fields' by S. E. Chandler (formerly principal, Plant and Animal Products Department, Imperial Institute), and 'Some Recent Results of Using Pyrethrins/Piperonyl Butoxide Liquids with Microsol Mechanical Fog Generator,' by Kenneth W. Hole (Microsol Industries, Ltd., London).

Next Week's Events

MONDAY 15 DECEMBER

Society of Chemical Industry

Bradford: Technical College, 7 p.m. Joint meeting of the Yorkshire Section with the Bradford Chemical Society. Dr. J. A. Storrow: 'Hydroextraction.'

London: Burlington House, Piccadilly, W.1, 5.30 p.m. Crop Protection Panel of the Agriculture Group. H. E. Harbour (Cooper Technical Bureau): 'Chemical Control of Animal Parasites.'

Institute of Metal Finishing

Birmingham: Grand Hotel, Colmore Row, 7 p.m. Annual Midlands dinner-dance. Reception by the chairman, W. F. B. Baker and Mrs. Baker, supported by the president and Mrs. H. Silman.

London: Northampton Polytechnic, St. John Street, E.C.1, 6 p.m. A. W. Wallbank: 'Some Aspects of Barrel Plating.'

TUESDAY 16 DECEMBER

Society of Chemical Industry

Falkirk: Lea Park Rooms, 7.30 p.m. Stirlingshire and District Section. A. B. Crawford: 'Instrumentation in Analytical Chemistry.'

London: Royal College of Science, Imperial Institute Road, South Kensington, S.W.7, 2.15 p.m. Agriculture Group. Three papers on: 'The Determination of Phosphorus and Potassium in Acid Extracts of Soils,' followed by discussion. Dr. J. H. Hamence (Dr. Bernard Dyer & Partners (1948), Ltd.) will give an introduction from the analyst's point of view; Dr. N. H. Pizer (National Agricultural Advisory Service, Cambridge) will deal with the adviser's viewpoint; and Dr. G. W. Cooke (Rothamsted Experimental Station, Harpenden), will discuss the correlation of crop responses to dressings of phosphate fertilisers.

Chemical Engineering Group (SCI)

London: Burlington House, Piccadilly, W.1, 5.30 p.m. Special meeting 5.30 p.m., followed by film show: 'The Dorr Way' (by courtesy of the Dorr-Oliver Co., Ltd.); and 'The Basic Principles of Lubrication' (by courtesy of the Esso Petroleum Co., Ltd.).

Oil & Colour Chemists' Association

London: 26 Portland Place, W.1, 7 p.m. Ladies' Night. Dr. F. Rushman: 'Radiochemistry in Paint Research.'

North East Metallurgical Society

Norton: William Newton School, 7.15 p.m. Dr. E. Voce: 'Recent Advances in Copper and Copper Alloys.'

Society of Instrument Technology

Manchester: College of Technology, Sackville Street, 7.30 p.m. J. E. Fielden: 'Measurement of Capacity and Its Application in Industry.'

WEDNESDAY 17 DECEMBER

Society of Chemical Industry

London: The Priory, Acton Lane, W.3, 6.30 p.m., by courtesy of the management, H. W. Nevill, Ltd. Food Group, special meeting for new members. Film display, informal refreshment, and opportunity to inspect the bakery of H. W. Nevill, Ltd.

Incorporated Plant Engineers

Rochester: Bull Hotel, 7 p.m. Kent Branch. F. L. Griffiths (Fraser & Chalmers, Ltd.): 'Planned Maintenance for the Plant Engineer.'

THURSDAY 18 DECEMBER

Society of Chemical Industry

London: Battersea Polytechnic, S.W.11, 6.30 p.m. Conversazione, Corrosion Group. Exhibits of scientific and industrial interest from many sources will be on view, and the new metallurgical laboratories of the Polytechnic will be open to inspection.

London: Institution of Electrical Engineers, Savoy Place, W.C.2, 6.15 p.m. Dr. Arthur Hughes: 'Aspects of Cell Life—Behaviour of Embryonic Cells in Tissue Culture.'

The Chemical Society

London: Burlington House, Piccadilly, W.1, 7.30 p.m. Reading of original papers. C. A. Coulson and G. R. Lester: 'Possible *f*-covalency in Uranium'; L. E. Orgel: 'Effects of Crystal Fields on the Properties of Transition-metal Ion'; H. C. Longuet-Higgins: 'Many-centre Bonds in Some Electron-deficient Molecules.'

Institution of Chemical Engineers

Birmingham: University, Edmund Street, 6.30 p.m. Graduates' and Students' Section, Midlands Centre. A debate: 'This House Considers that the Chemical Engineer Has No Place in Industry.' Proposed by Dr.

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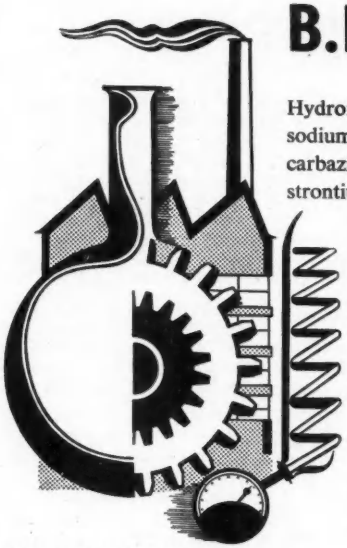

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Law & Company News

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary but such total may have been reduced.)

CHEMICAL ENGINEERING WILTONS, LTD. (formerly CHEMICAL ENGINEERING & WILTON'S PATENT FURNACE CO., LTD.), Horsham. (M., 13/12/52.) 6 November, mortgage and debenture to District Bank, Ltd., securing all moneys due or to become due to the bank; charged on mansion house.

Satisfaction

MURRAY (SCIENTIFIC INSTRUMENTS), LTD., Liverpool. (M.S., 13/12/52.) Satisfaction, 8 November, of mortgage registered 21 February, 1947, to the extent of £3,750 (specified property having been released therefrom).

New Registrations

Chemoleum (England) Ltd.

Private company. (513,900). Capital £100. Manufacturers and dealers in chemicals and general merchandise, etc. Subscribers: L. A. Clark and R. Holt, 77 Buckland Way, Worcester Park, Surrey. First directors to be appointed by subscribers.

Company News

Murex Ltd.

Provision allotment letters for the issue by Murex, Ltd., manufacturers of metallurgical, chemical, and engineering products, of 200,000 new ordinary £1 shares at 48s. a share on a one-for-10 basis, have been posted to stockholders registered with the company on 25 November. Net proceeds are estimated at £465,000 and the issue has been underwritten by Rowe, Swan & Co. The board expects that the present ordinary dividend rate will be able to be maintained on the increased capital.

The Distillers Company

The directors of The Distillers Co., Ltd., have declared an interim dividend on the ordinary capital for the year ending 31 March, 1953, at three and three-fifths pence per 4s. share, less income tax at the rate of 9s. 6d. per £, payable 28 February, 1953.

'Isoniazid' Resistance

IT has been found in America that 'Isoniazid,' or *iso*nicotinyl hydrazide, the promising new anti-TB drug under trial, breeds resistant strains 1,000 times faster than does streptomycin. Only a few of the bacilli develop resistance at first, and these are not resistant to streptomycin, and for this reason a properly chosen combination of isoniazid with streptomycin or one of several other antibiotics tried should kill all the bacilli before multiple resistance develops. The problem is complicated, however, by possible antagonism between 'isoniazid' and streptomycin, which occurs if not enough streptomycin is used, when the bacilli build up resistance even faster than to 'isoniazid' alone. Less antagonism was found using insufficient amounts of aureomycin or terramycin, and none at all with PAS, amithiozone, viomycin, or neomycin. Even with isoniazid-resistant bacteria, however, growth is much slower in the presence of the drug. Streptomycin-resistant strains grow at the same rate as ordinary strains.

Next Week's Events

(*continued from page* 814)

E. R. Walgrove; opposed by Professor F. Morton.

Purchasing Officers' Association

Dundee: Royal Hotel, 7.30 p.m. Film show and demonstration. P. Davidson (technical representative, Pilkington Bros., Ltd.): 'The Manufacture of Polished Plate Glass.'

FRIDAY 19 DECEMBER

Institution of Highway Engineers

Prescot: Council Offices, Whiston, 5.30 p.m. A. E. Lawrence: 'Bituminous Emulsions.'

Market Reports

LONDON.—Business during the past week has been of routine nature with prices for the most part steady at recent levels. A reduction in the price of acetic acid has been announced by the makers, glacial being £12 per ton less, the 80 per cent pure and technical £10 per ton less. A new price schedule has been issued for dibutyl phthalate, which has been reduced by 2½d. per lb. as from 8 December. Some improvement in the demand from the textile industry has been reported and the has been a steady call for deliveries against contracts. The volume of overseas inquiry is reasonably good, with supplies being offered for export at competitive rates.

MANCHESTER.—Prices on the Manchester chemical market during the past week in respect of the general run of heavy chemical productions have been maintained, though in several sections the tendency seems to be easy rather than strong. The call for chemicals for the textile bleaching, dyeing and finishing trades continues to pick up slowly and in most other directions the home-trade demand has been fairly active, though so far as new business is concerned most buyers are proceeding slowly and are likely to continue to do so until after the turn of the year. There has been little change in the position of the export trade in chemicals.

GLASGOW.—Overall trade has been steady throughout the past week, although the demand from the paper and paint trades is still somewhat slow. Textile chemicals, on the other hand, continue to move more easily. The export position remains practically unchanged.

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive, or a woman aged 18-59 inclusive, unless he or she, or the employment, is excepted from the provisions of the Notifications of Vacancies Order, 1952.

EXPERIENCED EXPORT CLERK required by established City exporters of chemicals for their selling department. Age below 32. Commercial or chemical studies would be an advantage. Apply **BOX No. C.A. 3185, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

EXPERIMENTAL OFFICERS AND ASSISTANT EXPERIMENTAL OFFICERS in various Government Departments. The Civil Service Commissioners invite applications for permanent and pensionable appointments to be filled by competitive interview during 1952.

The posts are divided between following main groups and subjects (*a*) Mathematical and Physical Sciences, (*b*) Chemistry and Metallurgy, (*c*) Biological Sciences (Biological research and Infestation control) to a total of seven posts, (*d*) Engineering subjects and (*e*) Miscellaneous (including e.g. Geology, Library and Technical Information Services).

Age limits: For Experimental Officers, at least 26 and under 31 on 31st December, 1952; for Assistant Experimental Officers at least 18 and under 28 on 31st December, 1952. Extension for regular service in H.M. Forces.

Candidates must have obtained, or be taking examinations during 1952 with a view to obtaining, the Higher School Certificate with mathematics or a science subject as a principal subject, or the General Certificate of Education in appropriate subjects, or the Higher National Certificate or other specified qualifications.

Candidates without such qualifications may be admitted exceptionally on evidence of suitable experience. Candidates over 20 will generally be expected to have higher qualifications.

Inclusive London salary scales:—

Experimental Officer £628-£786 (men); £533-£655 (women).

Assistant Experimental Officers £274-£586 (men); £274-£490 (women).

Starting pay according to age up to 26. At 18, £274; at 26, £495 (men), £467 (women). Somewhat lower rates in the provinces.

Further particulars and application forms from the **CIVIL SERVICE COMMISSION, SCIENTIFIC BRANCH, TRINIDAD HOUSE, OLD BURLINGTON STREET, LONDON, W.1,** quoting **No. S94-95/52.** Completed application forms must be returned by 31st December, 1952.
19447/40/EGS.

WANTED—WATERPROOFING ENGINEER

IMPORTANT South African Chemical Organisation has a vacancy for a **CHEMICAL ENGINEER** with extensive experience in the production and application of bituminous waterproofing compounds for large water conservation schemes, structural waterproofing, swimming baths, etc. Must be able to prepare estimates for contracts. Commencing salary from £1,500 to £2,000 per annum, commensurate with ability and experience. Excellent prospects for the right man. Apply in the first instance with copies of testimonials and full details to **BOX No. C.A. 3186, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

SITUATIONS VACANT

MICROBIOLOGIST. Company engaged in fermentation industry has a vacancy for a Microbiologist for routine maintenance of pure cultures, both in laboratory and development of early stages in plant. The successful applicant will also be required to carry out a certain amount of research work in connection with the growing of organisms and the recovery of products of metabolism. A flair for and an interest in this kind of work, together with previous experience, will be useful. Salary, etc., according to experience and qualifications. Appointment is in East Anglia. Full details to **BOX No. C.A. 3184, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

SENIOR SCIENTIFIC OFFICERS; SCIENTIFIC OFFICERS; PATENT EXAMINER AND PATENT OFFICER CLASSES. The Civil Service Commissioners invite applications for permanent and pensionable appointments to be filled by competitive interview during 1952. The Scientific posts are in various Government Departments and cover a wide range of Scientific research and development in most of the major fields of fundamental and applied science. The Patent posts are in the Patent Office (Board of Trade), Admiralty and Ministry of Supply.

Candidates must have obtained a university degree with first or second class honours in an appropriate scientific subject (including engineering) or in Mathematics, or an equivalent qualification; or for Scientific posts, possess high professional attainments. Candidates for Senior Scientific Officer posts must in addition have had at least three years' post-graduate or other approved experience.

Age Limits: Senior Scientific Officers, between 26 and 31; for Scientific Officers and Patent Classes, between 21 and 28 during 1952 (up to 31 for permanent members of the Experimental Officer class competing as Scientific Officers). London salary scales: Senior Scientific Officers (men) £812-£1,022; (women) £681-£917; Scientific Officers (men) £440-£707; (women) £440-£576; Patent Examiner and Patent Officer Classes (men) £440-£655. (Rates for women under review). Somewhat lower rates in the provinces.

Further particulars and application forms from **CIVIL SERVICE COMMISSION, SCIENTIFIC BRANCH, TRINIDAD HOUSE, OLD BURLINGTON STREET, LONDON, W.1,** quoting **No. S.53/52** for Senior Scientific Officers and **S.52/52, S.128/52** for the other posts. Completed application forms must be returned by 31st December, 1952.
19147/40/SD.

FOR SALE

CHARCOAL, ANIMAL AND VEGETABLE, horticultural, burning, filtering, disinfecting, medicinal-insulating; also lumps ground and granulated; established 1830; contractors to H.M. Government.—**THOS. HILL-JONES, LTD., "INVICTA" MILLS, BOW COMMON LANE, LONDON, E. TELEGRAMS: "HILL-JONES, BOCHURCH LONDON," TELEPHONE 3285 EAST.**

GRAVITY Roller Conveyor several lengths, Rolls. 2½ in. diam. by 16 in. 3 in. centres. Good condition. **THOMPSON & SON (MILLWALL), LIMITED, CUBA STREET MILLWALL E.14.** (Tel.: East 1844.)

SCREENLESS PULVERIZERS for fine grinding of Chemicals. Also **CYCLONES, ROTARY VALVE FEEDERS.** Callow (Engrs.) Ltd. Kirkby Trading Est., Liverpool.

FOR SALE

3 JACKETED **INCORPORATORS,** double "Z" arms, double geared, power-driven tipping motion, with counterbalancing weights.

1—Baker Perkins **MIXER** as above, not steam jacketed, single geared, complete with 25 h.p. A.C. motor.

3—Baker Perkins and Werner Jacketed **MIXERS** screw tipping pattern, friction pulley drive, single geared, with double-fin type agitators.

4—Gardner **RAPID SIFTER MIXERS** and **MIXERS** only, various sizes, one with brass fitted interior and glass-lined end plates.

27—Various **POWDER DRESSING** or **SIFTING MACHINES,** totally enclosed, with barrels from 80 in. long by 22 in. diam. to 120 in. long by 30 in. diam., belt driven, with collecting worm in hopper bottoms.

1—Simon Horizontal Tubular **DRIER,** 12 ft. long, 100 lb. steam pressure, size 3B, requiring 12 b.h.p.

4—Recessed Plate **FILTER PRESSES,** 30 in. square, 70 plates in each, centre fed.

5—Johnson **FILTER PRESSES,** 24 in. square, side feed and enclosed delivery, fitted 29 plates and 30 frames.

1—Johnson **FILTER PRESS,** 36 in. square, plate and frame type, double inlet and enclosed delivery ports.

Johnson Oil **FILTER PRESS,** Premier type; plates 2 ft. 8 in. by 2 ft. 8 in., of which there are 45, with angle lever closing gear.

Johnson Experimental **PRESS,** fitted 11 plates, 19 in. square, with feed pump, reduction gearbox and electric motor.

Steam-heated **FILTER PRESS,** Premier type, 32 in. square, with 30 recessed plates.

Wood **FILTER PRESS,** fitted 69 ribbed plates, 2 ft. 8 in. square, with top centre feed and bottom enclosed delivery channel.

48 in. Hydro **EXTRACTOR,** self-balancing, swan-neck type, self-emptying bottom.

2—30 in. Swan-neck **HYDROS.**

1—26 in. Swan-neck **HYDRO**

Heavy Cake **CRUSHING MILL,** 2-pair high, by Nicholson, for cake up to 3 in. thick, rolls 30 in. long, top with coarse teeth 9 in. diam., bottom with finer teeth 12 in. diam.

5 Sets A.A. **CRUSHING ROLLS** for linseed, cotton seed, etc., 48 in. long, belt driven, with feed hopper, side frames, baseplate and striking gear.

Bennett Copper-built **EVAPORATOR,** 4 ft. diam. by 4 ft. 6 in. high, steam-jacketed bottom, mounted on legs, with swan-neck vapour pipe and separate vertical belt-driven vacuum pump.

Douglas **ROTARY PUMP** for oil, soap, etc., belt driven.

6 Various Horizontal Duplex **STEAM PUMPS,** Worthington and Tangye pattern, 1 in. to 2½ in. suction and delivery.

"U"-shaped Horizontal **MIXER,** 8 ft. long, 3 ft. wide, 3 ft. 3 in. deep, belt and gear driven, end outlet, square horizontal centre shaft with cast radial type mixing arms, last used for linoleum paste.

1—"U"-shaped **MIXER,** as above, but 7 ft. long.

4—5-roll **REFINERS,** fitted chilled iron, water-cooled rolls, 40 in. long, 16 in. diam., belt and gear driven, with clutch drive suitable for motor, by Baker Perkins, Ltd.

No. 2HS Hammamac **HAMMER MILL,** No. 1 size, Standard Miracle Mill, No. 2 size Standard Miracle Mill and a No. 3 Super Miracle Mill, with fans, piping and cyclones.

7 ft. Torrance Positive-driven **EDGE RUNNER,** 2 Vertical Paint Pug Mills, 2-bar Disc Paint Grinding Mills, and 2 Horizontal 40-gallon capacity Cox Pug Mills for paint.

RICHARD SIZER, LTD.
ENGINEERS,
HULL.
Telephone 31743

FOR SALE

600

SPECIAL PLANT

3 **BABCOCK & WILCOX BOILERS,** each approx. 25,000 lb. evap. 200 lb. pressure, for saturated steam, with Economisers, Chain grate stokers, two Boiler Feed pumps, Hopkinson fittings.

250 kW. STEAM ENGINE DRIVEN GENERATOR SET, 400 volts D.C. 3 wire, 625 amps. 375 r.p.m. with 365 B.H.P. Bellis & Morcom Engine. Steam pressure 180/195 lb. sq. in., exhausting to 60 lb. back pressure, with oil free exhaust. Cylinders 11 in. by 11 in. by 9 in.

250 kW STEAM DRIVEN GENERATOR SET, 400 volts D.C. 3 wire, 625 amps. 375 r.p.m. Direct driven by 365 H.P. Bellis & Morcom compound steam Engine No. 6203. Steam 180 lb. sq. in. exhausting to 26 in. vacuum and subject to valve setting could be modified for 160 lb. sq. in., and back-pressure up to 10/20 lb. At present installed with Surface Condenser by Bellis & Morcom, with circulating pump and Edwards Extraction Pump.

VERT. STEAM DRIVEN SENTINEL AIR COMPRESSOR by Allen McLellan. Series 140. Size B. Rated 250 c.f.m. 100 lb. W.P., when supplied with steam 60 lb. sq. in.

VERT. STEAM DRIVEN SENTINEL AIR COMPRESSOR by Alley McLellan. Series 23.C. Size 7. 500 c.f.m. 100 lb. W.P., with steam 200 lb. sq. in., exhausting to 60 lb.

1,000 kW. TURBO ALTERNATOR SET by Westinghouse. 400/440/3/50. Steam pressure 200 lb. sq. in. 3,000 r.p.m. Exhausting to Surface Condenser.

GEORGE COHEN SONS & CO., LTD.,
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Tel.: Shepherds Bush 2070 and
STANNINGLEY, NR. LEEDS
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SOLVENT EXTRACTION PLANT, unused, immediate delivery. Semi-continuous type suitable for processing fish meal and vegetable oil cakes. Capacity 30 tons per 24 hours. **ENGINEERING & INDUSTRIAL OIL PROCESSING RESEARCH COMPANY LIMITED, 38, GROSVENOR GARDENS, S.W.1. SLOane 6950.**

VERTICAL, riveted steel, totally enclosed, cylindrical **STORAGE TANKS,** fitted with manhole and cover.

Qty.	*Diameter*	*Height*	*Capacity (gals.)*
2	11′ 0″	26′ 0″	15,000
1	10′ 0″	29′ 0″	14,500
1	9′ 6″	34′ 0″	12,500
7	9′ 0″	16′ 6″ to 34′ 0″	6,500/13,700
10	7′ 6″	27′ 0″ to 30′ 0″	5,900/9,900
9	7′ 0″	30′ 0″	7,500
6	6′ 0″	28′ 0″ to 35′ 0″	5,000/7,500

Plate thickness approx. ¼″.

We can also offer new 30′×9′ welded tanks for early delivery.

F. BURRILL & CO.,
109, PENCISELY ROAD,
LLANDAFF, CARDIFF.
Tel.: Llandaff 95.

PHONE 98 STAINES

400—**GLAZED EARTHENWARE POTS,** approx. 6 in. by 6 in. diam.

200 TO 400 GALLON WELDED STEEL HOPPERS, approx. 4 ft. diam. by 6 ft. 6 in. high.

CONDENSERS—by Allen, 6 ft. 6 in. long by 2 ft. diam., 300 sq. ft. tubes.

CONDENSERS—All Aluminium, 10 ft. by 1 ft. 4 in. diam., 245 sq. ft. and 13 ft. by 12 in. diam.—130 sq. ft. tube area, many others.

24,000 GALLON STEEL SECTIONAL TANKS, 24 ft. by 20 ft. by 8 ft. deep.

UNUSED VACUUM OVENS, 8 ft. by 5 ft., 7 ft. by 4 ft. and 7 ft. by 3 ft., coils and jacketed, many smaller.

List of mixers, tanks, boilers and radiators on request.

HARRY H. GARDAM & CO., LTD.,
STAINES

FOR SALE

ECONOMIC BOILERS—9 ft. diam. by 12 ft. 6 in. Foster Yates, 200 lb. w.p.; 8 ft. diam. by 14 ft. Paxman, 180 lb. w.p.

NEW GALVANISED PIPING. Immediate delivery. Johnson Filter **PRESSES**, 25 in., 18 Frame, practically new.

FIVE new **FURNACE RETORTS**, 8 ft. diam., 6 ft. 8 in. deep, approx. 8 tons each. Welded Steel.

BENZOLE WASHER, lead lined, agitating gear, 7 ft. diam., 6 ft. 6 in. deep.

FIVE Dish-ended **NAPHTHA TANKS**, 18 ft. 6 in. long by 4 ft. 4 in. diam., two having agitators.

NINE New Welded **TANKS**, 13 ft. 6 in. long, 7 ft. diam. 3,100 gallons each.

TWO 35 ft. long by 9 ft. diam. Lead-lined **TANKS.**

Stainless Steel **FILTER TANK**, 3 ft. 6 in. diam.

ONE Stainless **CONICAL HOPPER**, 7 ft. 3 in. diam., overall depth, 7 ft. 6 in.

TWO Broadbent **WATER-DRIVEN CENTRIFUGES**, 30 in. diam., 12 in. deep, 1,150 r.p.m., 150 lb. pressure.

FOUR Papier-mache O.T. **TANKS**, 8 ft. 3 in. diam., 9 ft. deep. (Unused.)

SIX O.T. **TANKS**, 7 ft. diam. 14ft. deep, lined inside with acid-resisting bricks.

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FOUR Rectangular Lead-lined **TANKS**, 8 ft. by 4 ft. 6 in. by 2 ft. 6 in.

FORTY Riveted **RECEIVERS**, 8 ft. 6 in. long, 5 ft. 6 in. diam., 75 lbs. w.p.

CAST-IRON PIPES, 5000 ft. Each 6 in. and 8 in.

VALVES in Stainless, Gunmetal, Enamel Lined.

Free Catalogue, "Watkins Machinery Record," available

FRED WATKINS, COLEFORD, GLOS.

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30 CWT. CHAIN BLOCKS, 10 ft.-12 ft. lift, ex-Government surplus. £15 per set.

5 CAST-IRON JACKETED PANS, 36 in. diam. by 27 in. deep, 1½ in. bottom outlet. £20 each.

1 MILD STEEL WELDED OPEN-TOP TANK, 60 in. by 27 in. by 42 in. by ¾ in. plate. £25.

THOMPSON & SON (MILLWALL), LTD.,
CUBA STREET, MILLWALL, E.14.
TEL. EAST 1844.

MORTON, SON & WARD LIMITED,
offer
MIXERS

"MORWARD" 'U' shaped trough POWDER MIXERS in sizes 8 to 100 cu. ft., arranged with scroll type mixing gear.

ONE 3 cwt. capacity **GARDNER** trough mixer, stainless steel lined trough and twin chrome plated scroll blades mounted on s.s. shaft. Fast and loose pulley drive.

Horizontal **CHURN** type **MIXING VESSELS** and vertical mixing vessels totally enclosed and open top in various sizes.

All types of **MIXING VESSELS** constructed to suit requirements.

ONE 600 gallon totally enclosed **JACKETED AUTOCLAVE** with detachable top cover, of riveted construction, suitable for 180 lb. p.s.i. w.p. in jacket and 100 lb. w.p. internally.

JACKETED PANS

100, 150 and 200 gallon new **JACKETED PANS**, all welded, mounted on three legs.

HYDRO EXTRACTORS

Large selection from 72 in. to 26 in. by **BROADBENT & WATSON LAIDLAW** in stock.

CENTRIFUGAL SEPARATORS by **ALFA-LAVAL** and **SHARPLES**, 400/3/50.

ENQUIRIES INVITED
MORTON, SON & WARD, LIMITED,
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LANCS.
Phone Saddleworth 437.

FOR SALE

2–800 GALLON Aluminium lined horizontal enclosed cylindrical welded steel **TANKS**, double compartment, 400 gallons each. Insulated. 1—1,050 **GALLON** Aluminium lined vertical cylindrical steel **TANK**, open top with hinged aluminium lid. Full details from :—

WILLIAM R. SELWOOD, LTD., CHANDLER'S FORD, HANTS. PHONE : 2275.

SALE BY PRIVATE TREATY

SALE BY PRIVATE TREATY
THE CHEMICAL MANUFACTURING WORKS
known as
THE OCEAN CHEMICAL COMPANY LIMITED
(in liquidation)
RAMSBOTTOM, LANCS.
THE CHEMICAL MANUFACTURING PLANT AND MACHINERY
comprising :

Graphite, Electrolysis Plant, Caustic, Brine and Bleach Powder Plant, together with Electricity Generating Plant, Steam Boilers and Economisers, Pumps, all Works Equipment, Mechanics' Shop, Stores, Offices and Motor Vehicles.

The Plant is being fully maintained and production could commence within two to three weeks.

THE BUILDINGS are held on a 99 years' lease from July, 1932, and contain an approximate floor area of 50,500 square feet.

Inquiries to :
JAMES MOSS, F.S.A.A. (Liquidator)
(John W. Hirst & Co.)
28, Queen Street, Manchester, 2.

WANTED

INDUSTRIAL BY-PRODUCTS, LTD., 16, Philpot Lane, London, E.C.3, will be pleased to receive particulars of any by-products, waste materials and residues for disposal.

PATENTS & TRADE MARKS

KING'S PATENT AGENCY, LTD. (B. T. King, A.M.I.Mech.E., Patent Agent), 146a, Queen Victoria Street, London, E.C.4. ADVICE Handbook, and Consultation free Phone: City 6161.

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CRUSHING, GRINDING, MIXING and DRYING for the trade.

THE CRACK PULVERISING MILLS, LTD.
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W. PODMORE & SONS, LTD.,
SHELTON, STOKE-ON-TRENT
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